Electrical World

DECEMBER 11, 1943

IDAHO POWER COMPANY—JOB BREAKDOWN

TABLE I

PLANT

Complete Hydro-Turbine Unit
(1 Job Plate) Capacity 6,000 kw. Loss each 24 hours 144,000 kw.-hr. Loss in return at $.003 equals $432.00 each day.
Damaged. Shaft out plumb within .130". Stator must be realigned to rotor, recoiled, and rewindowed. All bearings to be inspected
Turbine runner to be metallized. Speed ring vanes to be repaired where broken.

JOB UNIT OPERATIONS	PROTECTION TO MEN AND EQUIPMENT	CONTROL POINTS	KNOWN FACTS	CREW REQUIREMENTS A	B	D
Check out deterating if water has been removed, gates locked, and switches tagged.	Extra instruction is safety must be given to be sure that all precaution against accidental opening of head gates and closing of switches has been taken.	Conditions suggest the need for care and constant supervision. Improper supervision may lead to equipment or delay.	A critically needed generating unit is out of service. Inexperienced help will be employed.	2	3	1
Uncover generator by removing hood.	Check head gates and switches against accidental operation.					
Inspect crane, electrically and mechanically; lubricate.	Operation of crane must be restricted to one operator.	Supervision should be provided to see that all precautions are taken.				
Assign dependable member of crew to keep tools and parts in proper order.	The giving of signals must be restricted to an alert and experienced workman.	Adequate protection should be provided for handling parts.	Preventive have been taken against accidental opening of gates and operation of switches.			
Select rigging and prepare steel cable slings.	Designate signals and be certain all signals are fully understood. Use caution concerned about workman's ability to use wrenches safely.	Parts should be match marked.				
Spot crane over center of load. Install sling.	Be concerned about workman's ability to use wrenches safely.	Location for storage should be determined.	Head weighs about 2½ tons.			
Unbolt head. Remove all bolts and install temporarily two safety bolts sufficiently long to permit head to lift approximately six inches.	A workman to keep premises clear and small tools in place is highly desirable. Keep all oil and dirt from under foot. Be alert for good housekeeping.	Crane man receives signals from signal man on floor. Position signal man so signals are received clearly. Use safety factor of six or more.				
Take slight strain. Inch line on edge of head. Select suitable place for storing head. Remove head to storage	One 3/4" plow steel cable, with loop at each end long enough to place each loop on crane hook and, is recommended.					
Remove and tabs and fire line. Remove plates from rotor arms.	Use two 3/4" Crosby clamps at each loop with U of clamp on long end. Do not use bolt pulls. Look out for kinks and frayed wire ends and no loose ends. Protect hands always. Ragged wire ends are dangerous. Inspect lifting eye. Look for cracks in steel plate near eye. Note area of fouling. Be particularly alert when on slinging steel surface. Be fully concerned about the danger of metal heels and shoes. Shoes with leather soles and rubber heels are recommended. Check for free movement. Crane man must receive signals from signal man only.	Unnecessary delay and confusion will result by not providing adequate instructions for small parts.				
Install platform on lower flange of rotor arms. Clean all surfaces of oil, dirt and grease. Prepare alternate steel rs or ladder for work for plates, bolts, and pipe. Remove lower steel band from bolts.	Be sure that all bolts were removed. Be sure that load is not on side strain. Be sure that load is not on side strain. Be sure of clearance. Keep out from under load. Do not ride loads. Be slow. Look out for sharp edges. Adequate containers for small parts are necessary. Avoid dropping small parts. Recover immediately any small part or tool that falls. Guard against accident to men below. Exercise great care in handling bolts. Guard against injury to hands and feet. Consider danger in connection with the use of bolsteled shoes. Guard against injury to stator winding. Two men on motto pass bolts to one man on roof. Be sure to motto use of containers for small parts. Observe proper rigging for lifting.	Avoid mismatching parts and match mark parts before removing. Use 2nd piece out to fit. Parts must be match marked. Keep control by storing bolts in order of assembly.	Plates weigh 100 lbs. each. Bad bolts are bulky. Two or more men required to handle. Working conditions more or less precarious. Fire line is supported on certain bolts that cannot be taken out until fire line is tabulated and blocked. Bolts weigh around 50 lbs. each. Bolts are made of thin cast iron. There are 44 bolts.			
Unbolt and remove to outer, all bolts not used to support fire line.	Provide safe tools. Make certain of safe footing. Keep mind on job. Be dropped because they are made of Protect stator coils.	All bolts and nuts should be put together, nuts on bolt, in containers provided for this purpose. All doubtful matching should be sorted.	Fire line consists of 2" pipe. Each section of fire line weighs approximately 100 lbs.			
Rehoist fire line and block free of stator coils. Remove balance of nut bolts. Separate fire line into three parts; remove and store.	Use at least three men for this operation. Leather gloves are recommended. Guard against slipping wrenches. Use great care against dropping bolts on machine parts. Don't drop small parts into generator. Remove immediately any part that has been dropped. Don't lay parts or tools around journal to be accidentally pushed or kicked off, injuring men or machinery below.	Locate storage properly in the clear with adequate blocks. Keep control of assembly by checking match markings. Be concerned about total weight of rotating part in handling sling.	Fire line is attached to every other bolt with U bolts. Rotor now rests on step block. Weight of complete rotor is approximately 65 tons. Total weight of rotating part is around 115 tons. Stator to rotor clearance is around .125" average. Air gap is uneven. There are four legs on rotor.			

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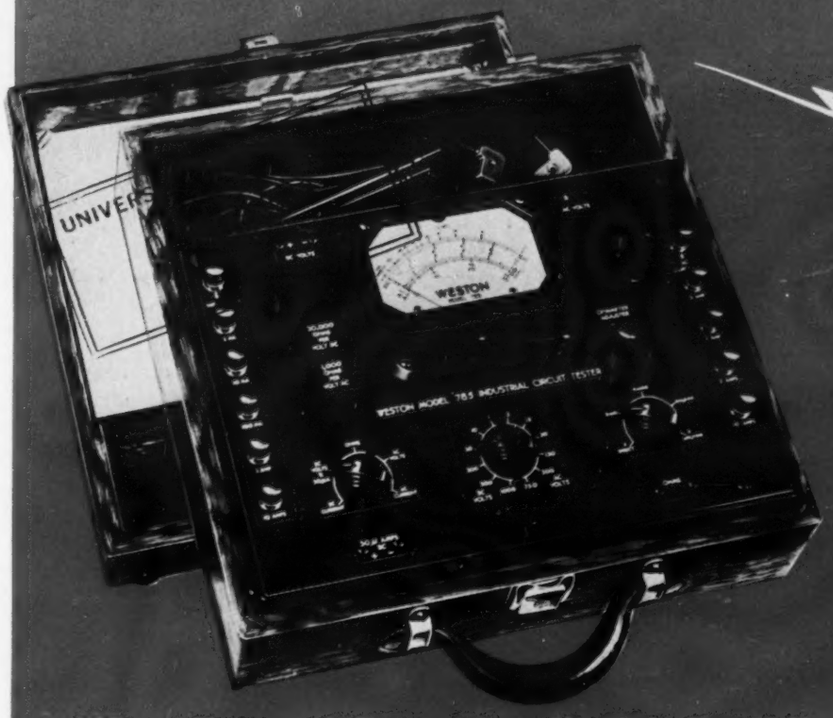
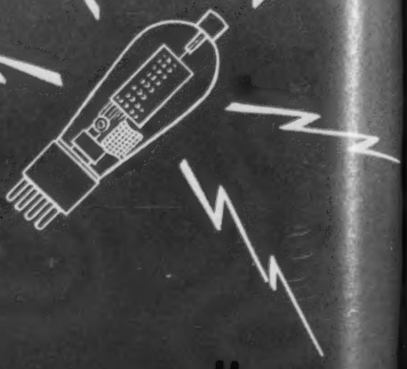
JOB BREAKDOWN FOR HYDRO-TURBINE OVERHAUL

MEASURES THE *new* MAINTENANCE VALUES





as well as the old . . .

Weston MODEL 785 Industrial Circuit Tester

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D-C Voltage—*Measurements from 10 millivolts to 1000 volts (20,000 ohms per volt) in full scale ranges of: 1/10/50/200/500/1000 volts. (Up to 5000 volts with very compact external multiplier.)*

A-C Voltage—*Measurements from 0.1 to 750 volts (1000 ohms per volt) in full scale ranges of: 5/15/30/150/300/750 volts.*

D-C Current—*Measurements from 0.5 microampere to 10 amperes, in full scale ranges of: 50 microamperes, 1/10/100 milliamperes, 1/10 amperes. (Higher ranges with external shunts.)*

A-C Current—*Measurements from 10 milliamperes to 10 amperes, in full scale ranges of: .5/1/5/10 amperes. Higher ranges, up to 1000 amperes, with external current transformers.*

Resistance—*Measurements from 0.5 ohm to 30 megohms in full scale ranges of: 3,000/30,000/300,000/3 meg./30 meg. Center scale values are: 25/250/2,500/25,000/250,000 ohms.*

• The growing use of electronic devices and other sen tive circuits throughout industry poses no new inst ment problems for contractors or maintenance dep ments WESTON equipped. The familiar Model 785, wi its high sensitivity and broad range scope, answers the *newer* measurement requirements. But more . . . it al covers most of the *usual* maintenance needs.

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December 11, 1943 — Vol. 120, No. 24

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PLACE TRANSFORMERS CLOSE TO THE STATION...

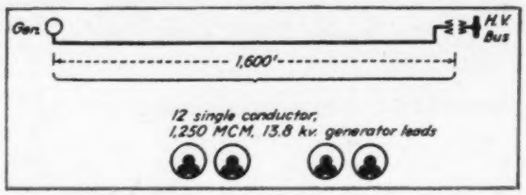
AND INSTALL OILOSTATIC HIGH-VOLTAGE TRANSFORMER LEADS HERE

COMPARE THE RELATIVE MERITS OF THESE TWO METHODS*

LOAD: 70,000 KVA to be carried 1600 feet from generator to switchyard.

A. CONVENTIONAL METHOD

(Transformer adjacent to switchyard)

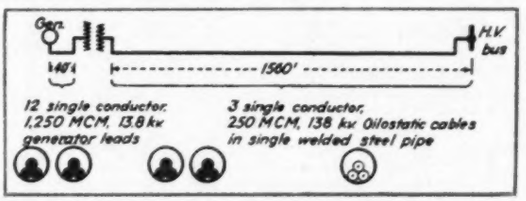


REQUIRED: 19,200 feet of 1,250 MCM, 13.8 KV Oilostatic transmission cable plus risers.

Total Copper — 77,538 Pounds.

B. NEW METHOD

(Transformer adjacent to generating station)


Gen.
H.V. bus
480'
1580'
12 single conductor, 1,250 MCM, 13.8 kv generator leads
3 single conductor, 250 MCM, 138 kv Oilostatic cables in single welded steel pipe

REQUIRED: 480 feet of 1,250 MCM, 13.8 KV Oilostatic transmission cable plus risers.

4680 feet of 250 MCM 138 KV Oilostatic transmission cable plus risers.

Total Copper — 7,562 Pounds.

RESULTS:

1. The new method 'B) requires only 9.76% of the copper needed in the conventional method (A).
2. Copper losses in (B) are only 18.75% of those in (A).
3. Cost of the *entire* cable installation in (B) is only 55% of the cost of the conventional method.
4. Improved lightning protection is gained through the capacity of the long length of cable between switchyard and transformer.

* Based on recent study of a proposed installation.

Through Okonite-Callender research the large savings inherent in high-voltage transmission can be more fully obtained by operating and station design engineers who take advantage of the improved layout permitted by Oilostatic high-voltage transformer leads. The only changes from conventional practice are to place transformers closer to the station and install high-voltage Oilostatic transformer leads between the high side of the transformers and the switchyard. Comparable savings are effected regardless of the type of cable used for low-voltage generator leads.

THIS METHOD HAS BEEN PROVED IN THE FIELD

An installation of this design is in operation at one of the largest base load stations in the United States (see Electrical World — Feb. 22, 1941). Moreover, the reliability and trouble-free performance of the Oilostatic high-voltage transmission system itself have been established through more than 11 years' experience in numerous other applications. For transmission circuits, stations, transformer and generator leads, it will pay you to consider this modern, economical cable transmission system. Write for Bulletins OK-1016 and OK-2028 . . . or talk it over with our engineers. The Okonite-Callender Cable Co., Inc., Passaic, N. J.

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Now this important reclaimable feature scores again. Vital materials from which Automatic Line Splices are made are mostly off to war . . . so it is impossible to supply the quantity of line splices we would like to but your stock bins will supply splices for immediate requirements.

Every "out of service" line equipped with Electroline Automatic Line Splices is a source of supply. These splices are reclaimable.

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Originators and Patentees of Automatic Line Splices and Dead Ends

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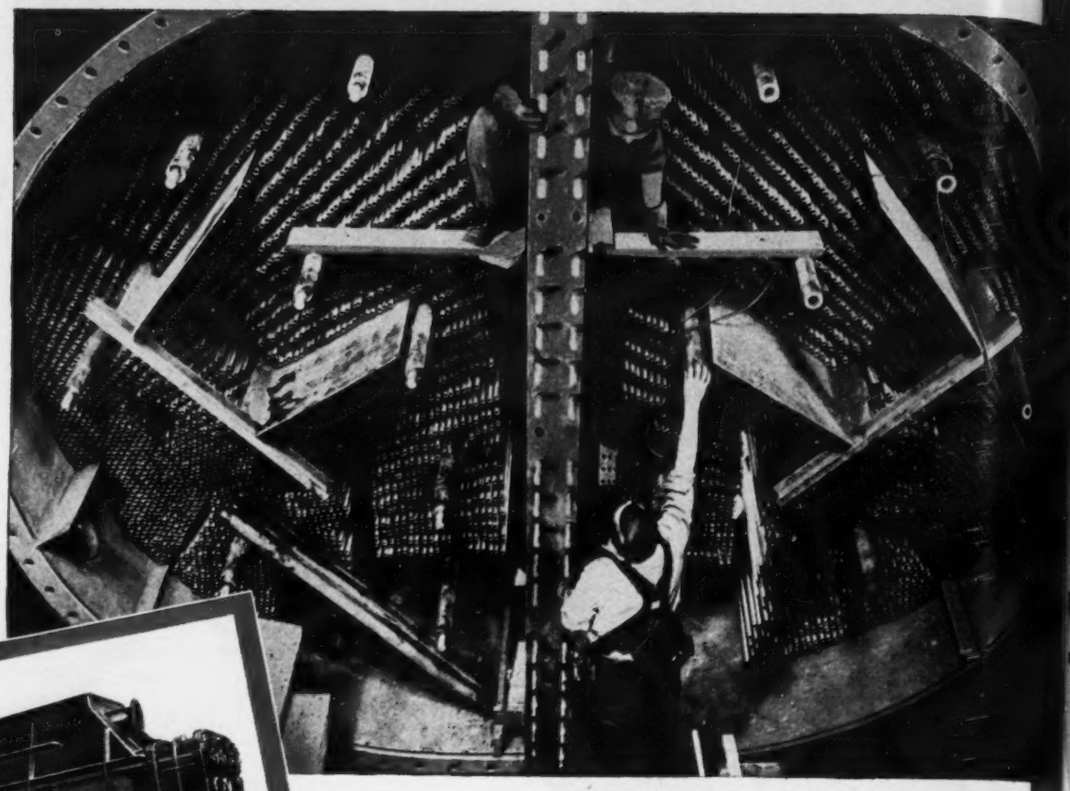

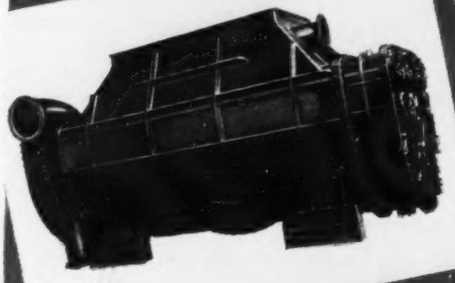

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means a unit tailored to the job, designed with Elliott experience and built with Elliott skill. If you have a condenser question, consult us.

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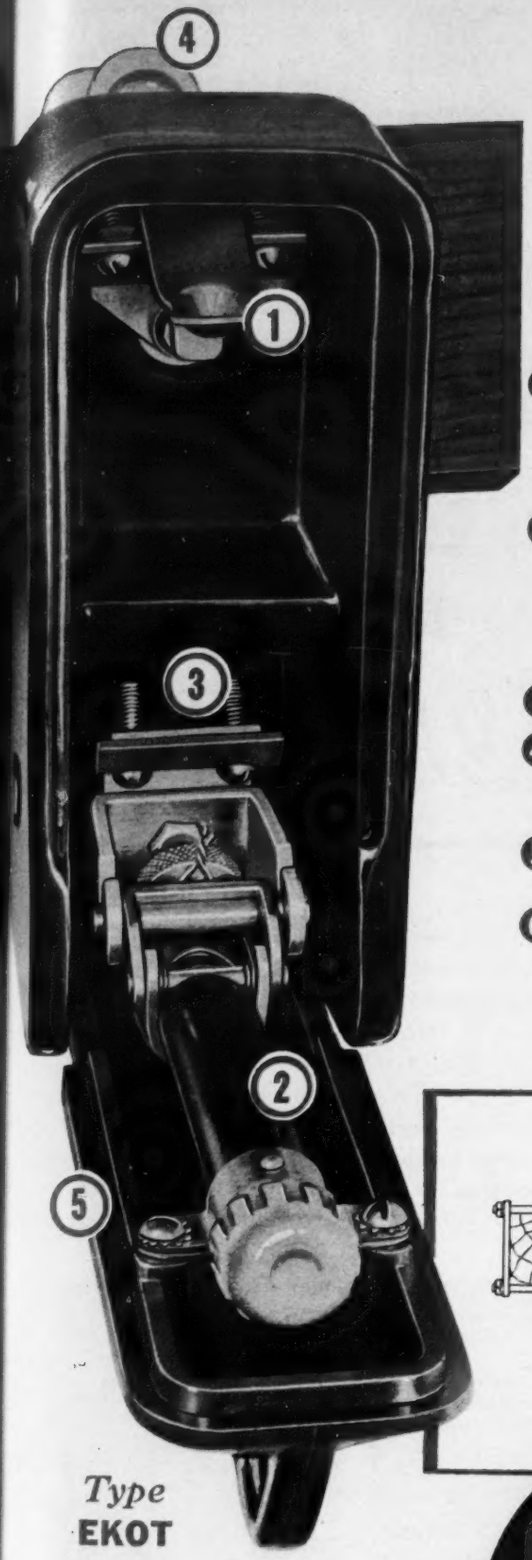
Exceptional condenser performance comes down to tube layout more than to any other single factor. Elliott engineers have worked out a distribution of tubes in converging straight lines—wide spacing at the top, decreasing to a minimum toward the point of lowest pressure at the air offtakes. This type of spacing insures uniform, maximum steam velocity which sweeps the tubes clear of condensate and non condensable gases.

A central steam lane feeds directly to the hotwell, assuring equal pressure and temperature at top and bottom of the unit, and the deaeration of the condensate to a point where air content does not exceed 0.03 cc per liter. There are no baffles to cause changes in direction of steam flow.

The photo shows a 27,000-sq. ft. Elliott condenser which is now on duty at an eastern utility. In construction and performance it is typical of the many Elliott condensers serving many power stations and plants.

CHECK the FACTS



Type **EKOT**

1. Heavy duty, HI-PRESSURE silvered contacts eliminate contact deterioration. Resilient beryllium copper spring insures continued contact pressure.
2. Extra heavy horn fibre lined bakelite expulsion tube accommodates any universal link - also provides highest interrupting capacity, with long life. R&IE Thermo-Rupters recommended because of their positive action.
3. Accessible terminal blocks, properly placed.
4. Heavy, adjustable hanger fitted with half-inch bolts insures rigid, permanent mounting in any position.
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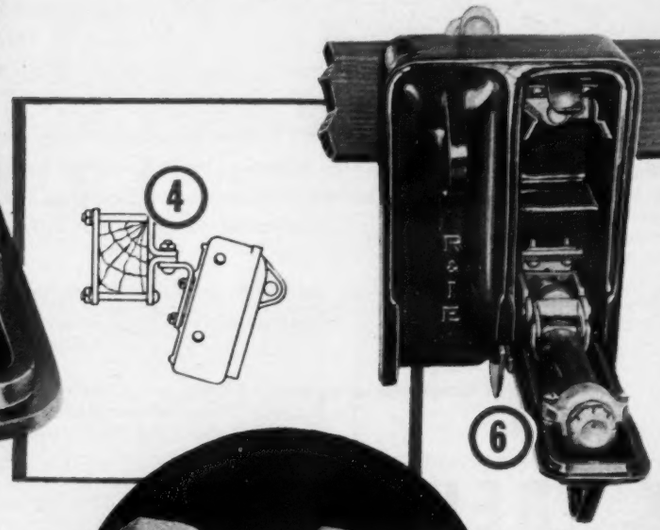
6. Cutout doors fully interchangeable between single and repeating cutouts.



Type **REKOT**

R&IE ENCLOSED CUTOUTS

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- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
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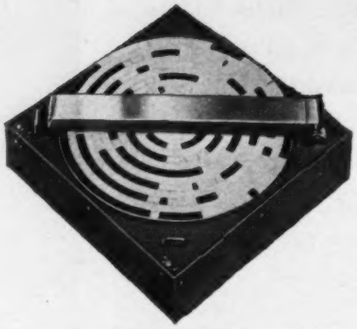

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This new development by the research laboratories of General Electronics Industries provides automatic control of chemical processes and also of production machinery, by means of printed charts which may be replaced or interchanged as readily as phonograph records.

● Jacks-of-all-trades have their place . . . but *not* in General Electronics Industries. Everyone in this organization, from top-flight research engineers to service men and their assistants, is an electronics specialist.

We have no miracle gadgets nor mysterious cure-alls for sale. Our business is the proper application of electronics to solve individual production problems. This begins with diagnosis, *follows through* with research, perhaps special design, and includes expert service before and after completion of the job.

To assist you in your post-war production planning, one of the largest organizations specializing in Electronics offers the skill, experience and unsurpassed facilities that have successfully met the most exacting tests of war.

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GENERAL Electronics INDUSTRIES

Division of Auto-Ordnance Corporation

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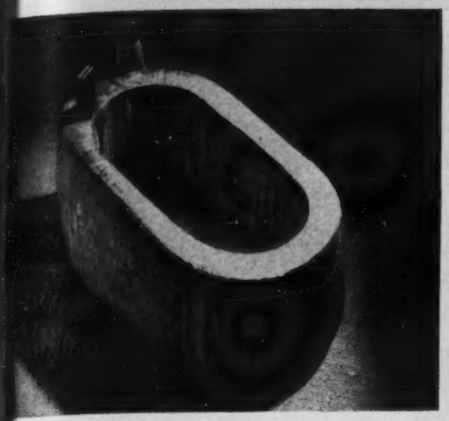
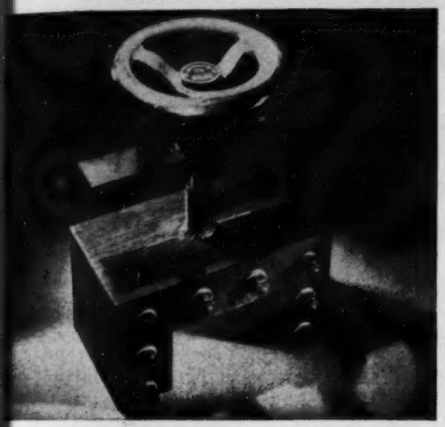
SEE WHY THIS NEW AMPAC "400" IS A BETTER A-C WELDER!

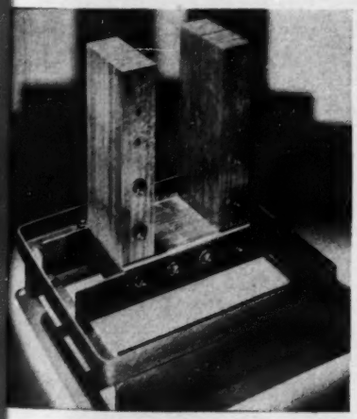


1 Reactor coil on Ampac a-c welder is compact, cool-operating. Oversize winding *dissipates* heat — *increases* efficiency. Spun-glass insulation is flame-proof!



2 Upper core moves only 1 inch . . . covering entire 50-500 amp welding range in *seven easy turns* of control wheel. *Cuts* welding time — *speeds* output!

3 Here's a-c welding at its newest and finest! Note simple design — rugged construction. Integrated reactor-transformer circuit provides noiseless, trouble-free operation . . . with minimum idling loss. Ampac gives you *all* a-c welding advantages — including *no arc blow!*



4 Rigid lower core is 1-piece, U-shaped . . . of die-punched silicon steel. *No* air gaps to waste valuable power!

5 Typical of Ampac's quality design is this big, tough welding terminal. Note permanent connections are *brazed!* A 1666

GET COMPLETE FACTS on Ampac . . . learn how its patented circuit cuts costs — increases production. Call on your nearby Ampac dealer or write for bulletin B6302. Also ask for B6241 on Ampac "200".

ALLIS-CHALMERS

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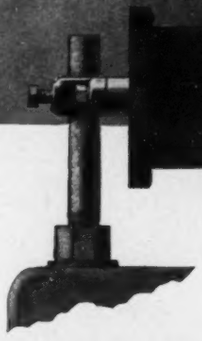
THE "FRAHM" VIBRATING REED TACHOMETER...

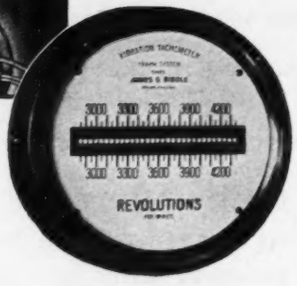
...is Simple as ABC



Above: Showing one method of mounting the Frahm Tachometer.

Below, left: Frahm Hand Tachometer.

Below, right: Frahm Permanent Mount Tachometer.



Consider the inherent simplicity of a tachometer that need only be mounted on or held in contact with the machine. It means:

No belts, flexible shafts, gears, or electrical connections.

No lubrication required; No maintenance.

Independence from any outside source of power.

And the Frahm Tachometer is as accurate as it is reliable. It functions faithfully without attention year after year because there are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or connecting wires—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Furnished in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, Diesel-electric installations, etc. Various ranges available from 900 to 30,000 r.p.m.

For a complete description of Frahm Tachometers, together with list of types and ranges commonly supplied, write for Bulletin 1590-W.

●

"FRAHM" VIBRATING-REED FREQUENCY METERS—operate on the same unique principle as Frahm Tachometers, except that reed vibration is produced electrically instead of by direct mechanical contact. Unaffected by wave form or ordinary temperature changes. Switchboard, portable and miniature types in various ranges from 10 to 500 cycles per second. Write for Bulletin 1695-W.

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KID-GLO
Jaws

Holding power sufficient to break any standard cable accommodated; yet, after years of installation, you can scarcely find the gripped area of the cable, so easily has this holding power been applied. There are no sharp bends, no deformation, no crushing of strands. O-B Hi-Lite clamps hold the conductor like a vise with kid-glove jaws! Cables "stay put" and last longer. Inspection and maintenance are reduced. All these things save money and give better utilization of reduced manpower. Specify O-B Hi-Lites on plans for your next line.

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LTD.,
NIAGARA FALLS, ONTARIO

2427-H

One died from SHELL SHOCK!

THESE two armor piercing shells *looked* perfect . . . until they were shock tested in three successive water baths . . . cold . . . boiling . . . cold. One *was* perfect. The other cracked . . . was rejected as unfit to fight.

Heating and cooling these baths is just one of countless ways in which General Electric heating, refrigeration and air conditioning are serving war industries.

In recent months, industrial refrigeration and air conditioning have made great strides. Equipment is more compact, more flexible. Temperature and humidity are controlled more exactly. Result: more and better fighting equipment...in shorter time.

After the war, improved process refrigeration should help to make many peace-time products better . . . at lower cost. And vastly improved air conditioning will provide greater comfort in more and more hotels, offices, stores, theatres, homes . . . even in cars, boats and planes.

The wide experience that General Electric engineers are gaining in war work today is your assurance that they will be ready with finer and more efficient refrigeration and air conditioning equipment for the needs of post-war America.

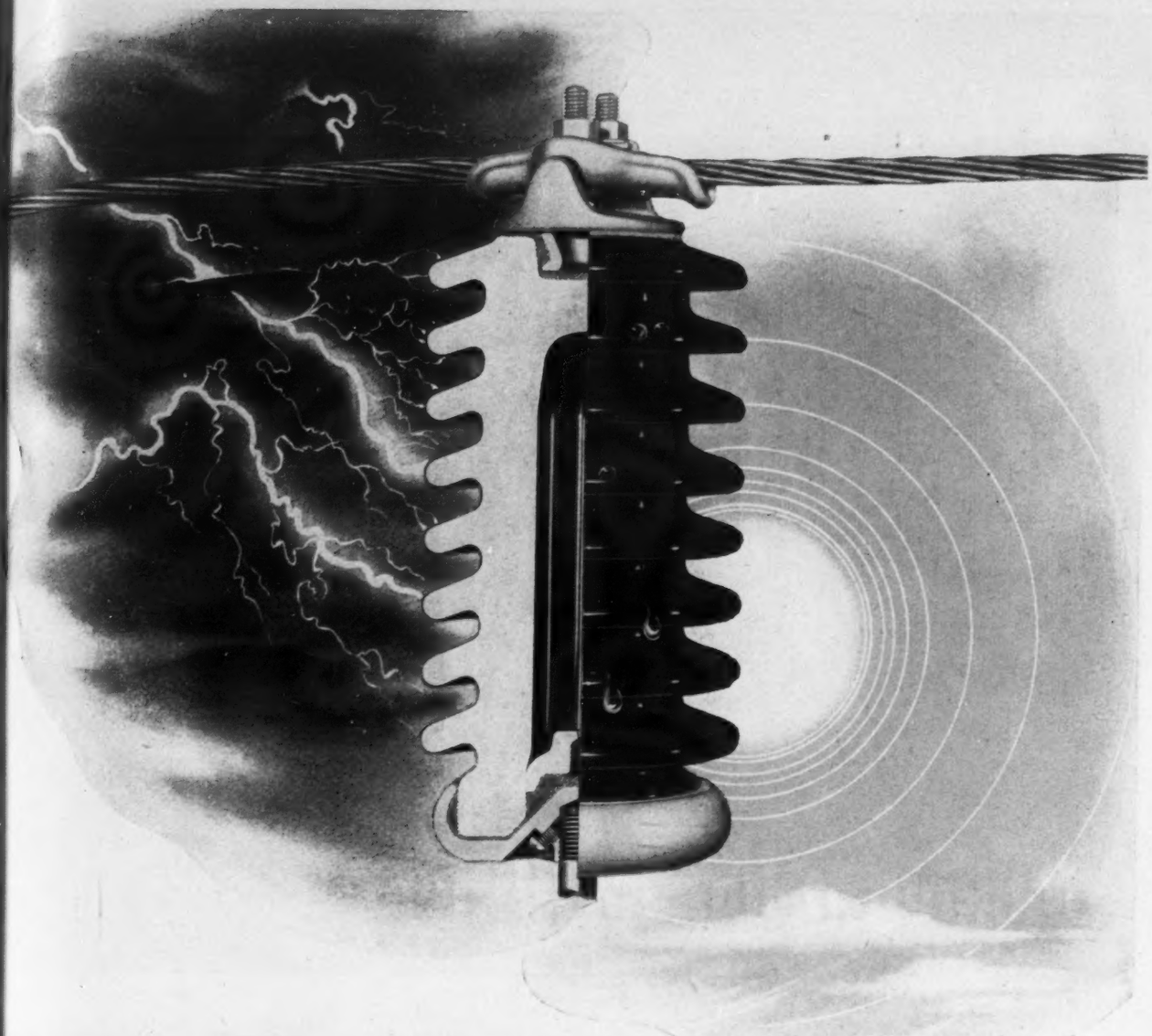
☆ BUY WAR BONDS ☆

Air Conditioning and Commercial Refrigeration Divisions, Section 4318 General Electric Co., Bloomfield, N.J.

Industrial Refrigeration by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays, 10 p. m., EWT, NBC . . . "THE WORLD TODAY" News, Every Weekday 6:45 p. m. EWT, CBS



You'll never see what makes an O-B line post work

In line post design, the *inside* is more important than the outside. The inner chamber must be totally dry--always! A moist surface here would cut out an important amount of insulation and place a hazardous electrical stress on the porcelain head. A steep front lightning flash can be fatal under these conditions.

Thermal cycles produce alternate pressures and vacuums in this closed chamber. Moisture does not tend to seep in--it's drawn in, if the seal is not perfect, even after years of exposure.

O-B line posts have this chamber sealed off with a porcelain barrier, glazed into place. Nothing is any more secure or more permanent. The inert dry gas which fills the chamber stays dry and, in turn, the insulator retains its original excellent electrical qualities indefinitely, despite climatic conditions.

If you favor the line post in your construction, be sure to specify O-B and get the ceramic seal to assure longest trouble-free service.

BACK THE ATTACK — BUY MORE WAR BONDS

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED,
NIAGARA FALLS, ONTARIO

2420-H

Making it hot for Hitler

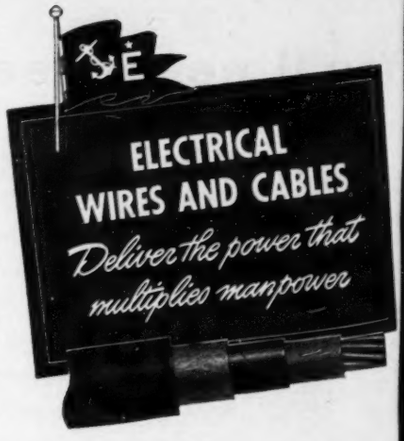
ONE of Hitler's greatest headaches is America's vast steel production—this year more by far than that of all the Axis countries combined.

The "hot seat" for Adolph is being made especially hot by America's great electric furnaces . . . for they produce the fine alloy steels that make the vital parts of our planes, guns, and ships just enough better to spell the Axis' doom.

These vitally important furnaces depend upon electric current—current which must be delivered unfailingly night and day. Only electrical wires and cables of the finest quality, of the utmost dependability, can be entrusted to this job.

We are proud that products of American Steel & Wire Company play such an important role in delivering power and light to America's vast war production machine. The quality of our electrical wires and cables is no accident. For years and years our engineering and production departments have worked for constant improvement.

And they continue to work on new ideas and developments to take care of the increased wartime demands for power and light and the ultimate conversion to peacetime requirements.



AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

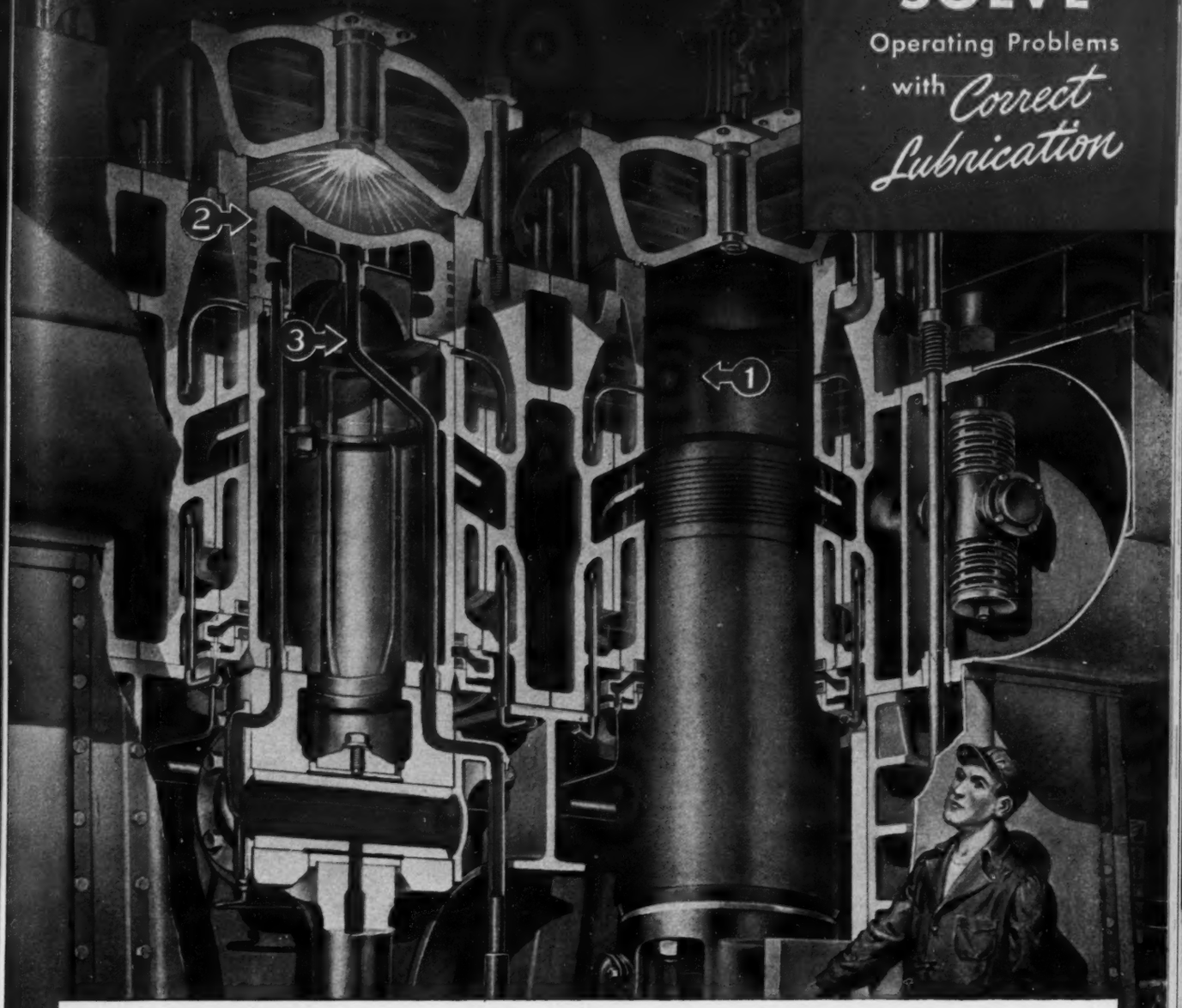
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

HOW TO SOLVE

Operating Problems with *Correct Lubrication*



Fight Heat, Pressure, Oxygen

PROBLEM: Heat, pressure, oxygen attack a Diesel lubricant between the faces of the rings and the cylinder wall (1, above) and between the rings and grooves (2, above). Its use as a coolant (3, above) also subjects it to oxidation. The lubricant must resist these attacks or it will form deposits, interfering with ring action and piston cooling.

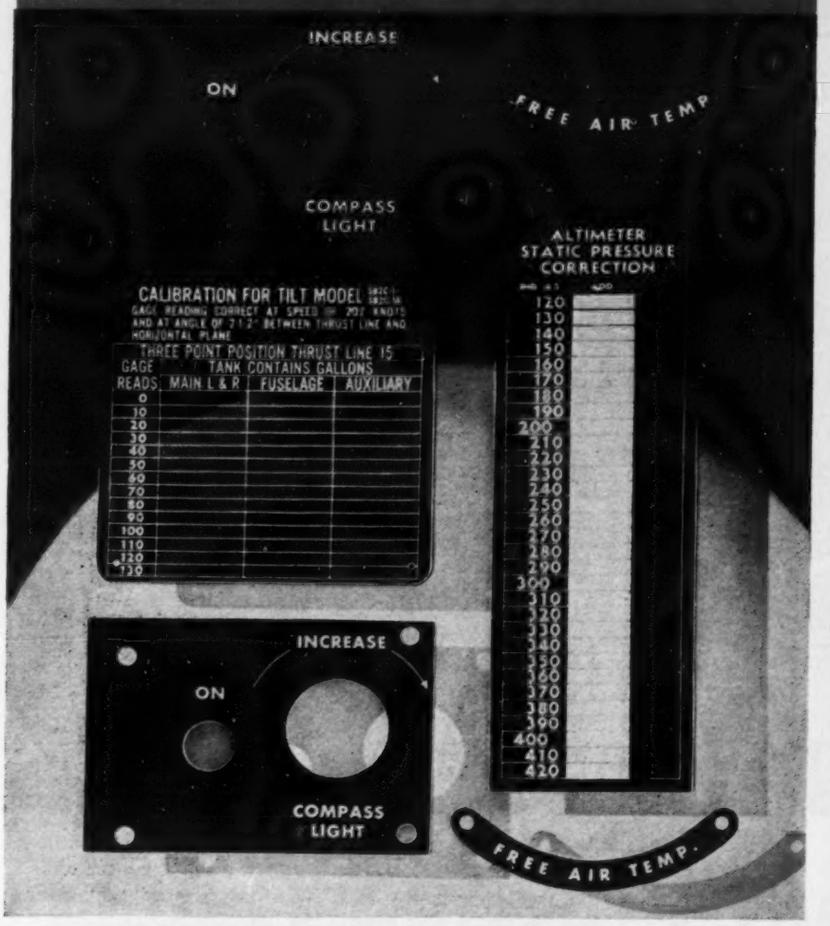
ANSWER: A line of famous Gargoyle Oils is made specifically for this purpose: *Gargoyle D. T. E. Oils Nos. 1 to 5.* In even the most severe Diesel operation, these oils resist oxidizing influences. They form a tenacious film that resists the wiping action of the piston rings. Wear, ring breakage and blow-by are all minimized. Piston cooling remains at maximum efficiency.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

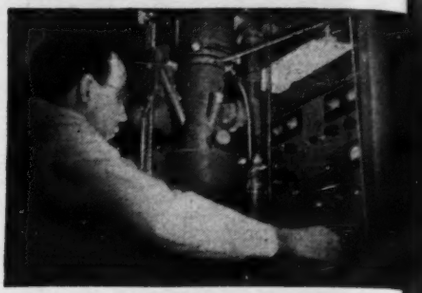
CALL IN SOCONY-VACUUM

LIFE ON THE PLASTICS NEWSFRONT



(*Above*) **ESSENTIAL PARTS** for "LAMICOID" instrument dials, panels, wiring diagrams, are being made from MELMAC* laminated sheets because of the high dielectric strength, surface hardness, heat resistance, and resistance to oils, solvents, cleaning compounds imparted by MELMAC resin. The typical parts shown here are fabricated from plastic laminated sheets, in a variety of thickness and in dimensions up to 36" x 42", made by the Mica Insulator Company. The MELMAC laminating resins include a range for the production of extremely hard to very flexible combinations. Other characteristics of laminates made with MELMAC resins include resistance to warpage and shrinkage and easy machineability. Further information on this and other Cyanamid laminating resins, LAMINAC* and MELURAC*, will be supplied on request.

(*Above*) **HUGE LAMINATING PRESS** at plant of Mica Insulator Company produces MELMAC laminates in a variety of types to meet many industrial needs.



(*Above*) **RESEARCH IN PLASTICS** to develop new applications and improved materials is carried on at Cyanamid's Stamford Research Laboratories with the aid of the most modern equipment such as the electron microscope shown here.

(*Above*) **NEW MANUAL ON MELMAC MOLDING COMPOUNDS** is now available to designers, engineers and others interested in the fabrication and use of plastics. It contains a complete summary of the latest information and technical data on molding methods, applications, design instructions, and property charts for the various MELMAC molding materials currently available. A request on your business letterhead will bring you your personal copy. *Reg. U. S. Pat. Off.

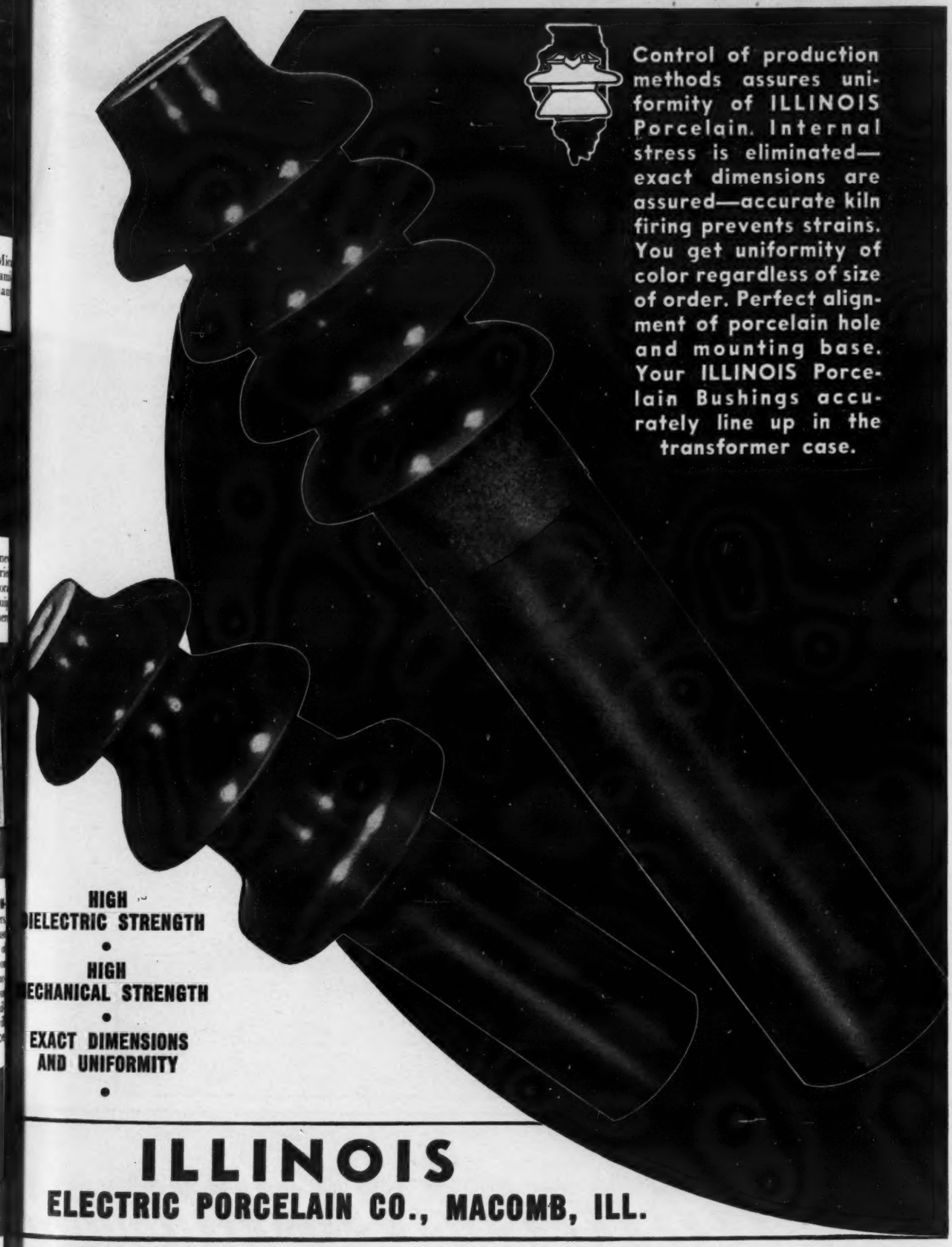
AMERICAN CYANAMID COMPANY • PLASTICS DIVISION • 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC · URAC · MELURAC · LAMINAC

You Get Uniformity In

ILLINOIS PORCELAIN BUSHINGS



Control of production methods assures uniformity of ILLINOIS Porcelain. Internal stress is eliminated—exact dimensions are assured—accurate kiln firing prevents strains. You get uniformity of color regardless of size of order. Perfect alignment of porcelain hole and mounting base. Your ILLINOIS Porcelain Bushings accurately line up in the transformer case.

HIGH DIELECTRIC STRENGTH

•

HIGH MECHANICAL STRENGTH

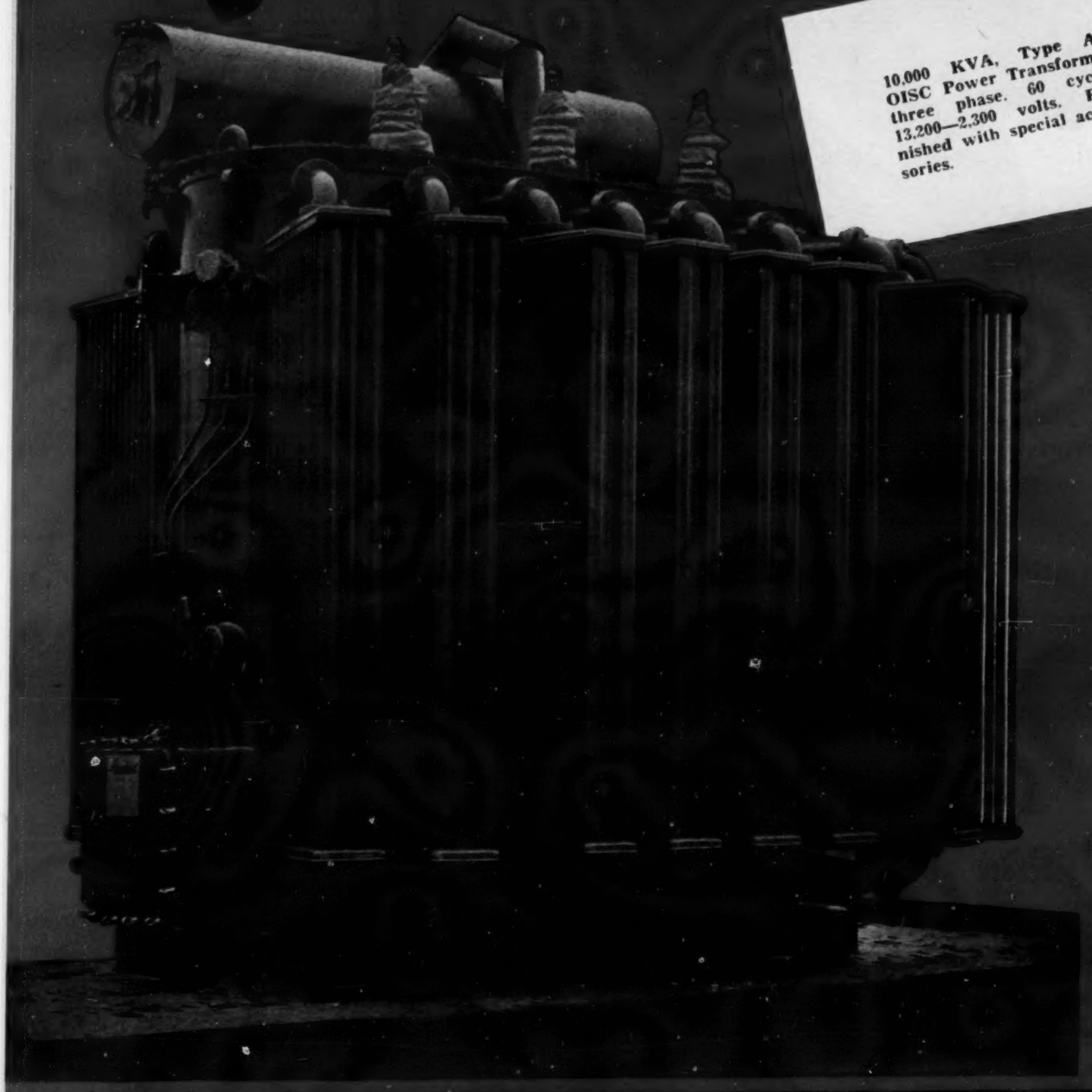
•

EXACT DIMENSIONS AND UNIFORMITY

•

ILLINOIS
ELECTRIC PORCELAIN CO., MACOMB, ILL.

You still



10,000 KVA, Type AT, OISC Power Transformer, three phase, 60 cycles, 13,200—2,300 volts. Furnished with special accessories.

The Standard Transformer

WARREN ··· OHIO

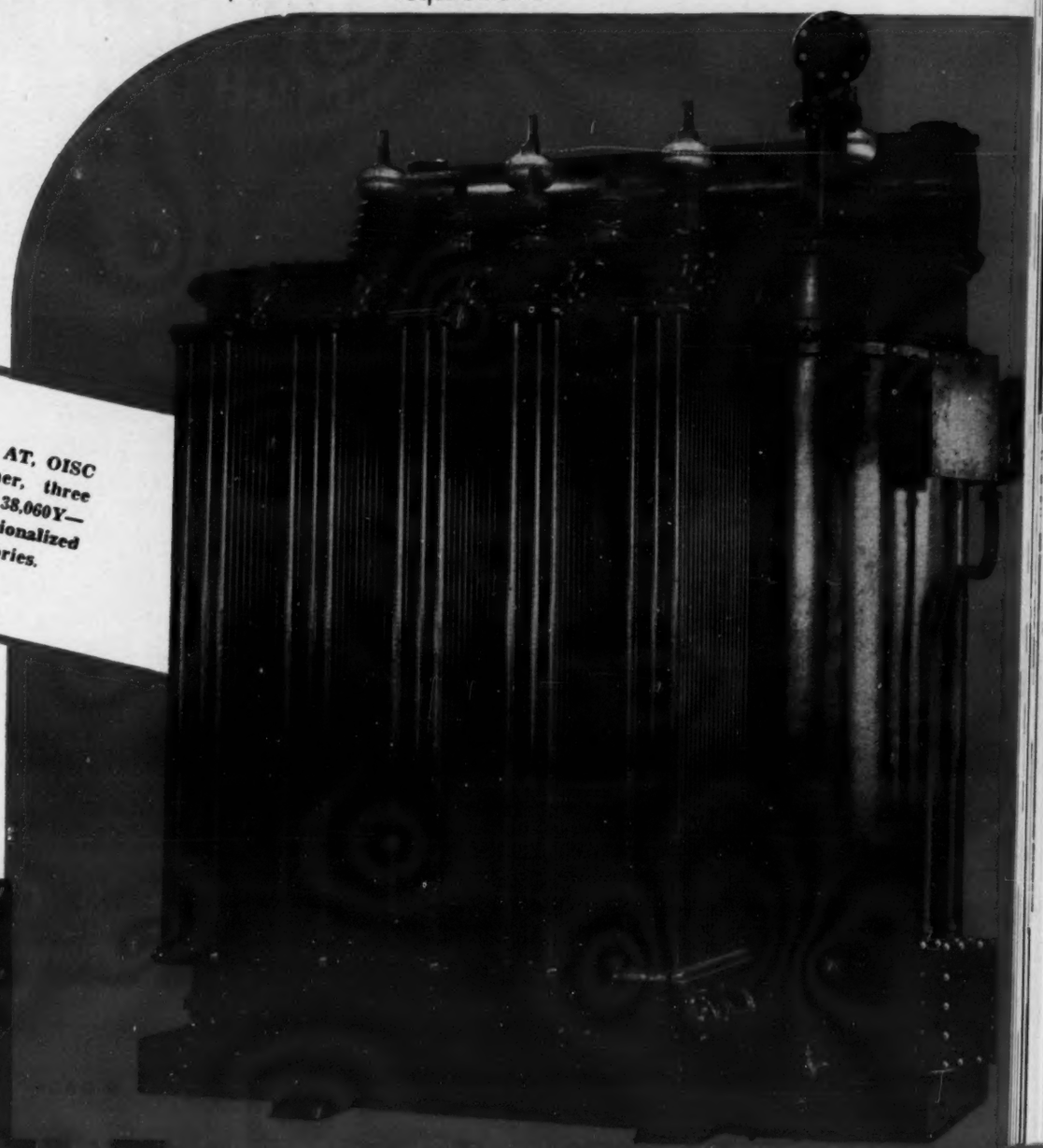
...vant Quality

While we're all rushing to complete the jobs ...ssigned to us in the nation's war effort, let's not ...orget that the transformers which are being rushed ...way from factory production lines to important ...efense installations must be able to withstand more ...buse than those manufactured in normal times.

These transformers, which are being shipped to Army and Navy Bases, Ordnance Plants and other war-time projects, must not become 'war babies,' otherwise the material and time thus expended in production are irrevocably lost and our war program will be subjected to critical delays.

An experienced inspection department, closely co-ordinated with our production force, enables The Standard Transformer Company to produce transformers at war-time speed without sacrificing the qualities that are essential to the efficient and trouble-free operation of any transformer.

Our nearest sales representative will be glad to confer with you promptly about your transformer requirements.

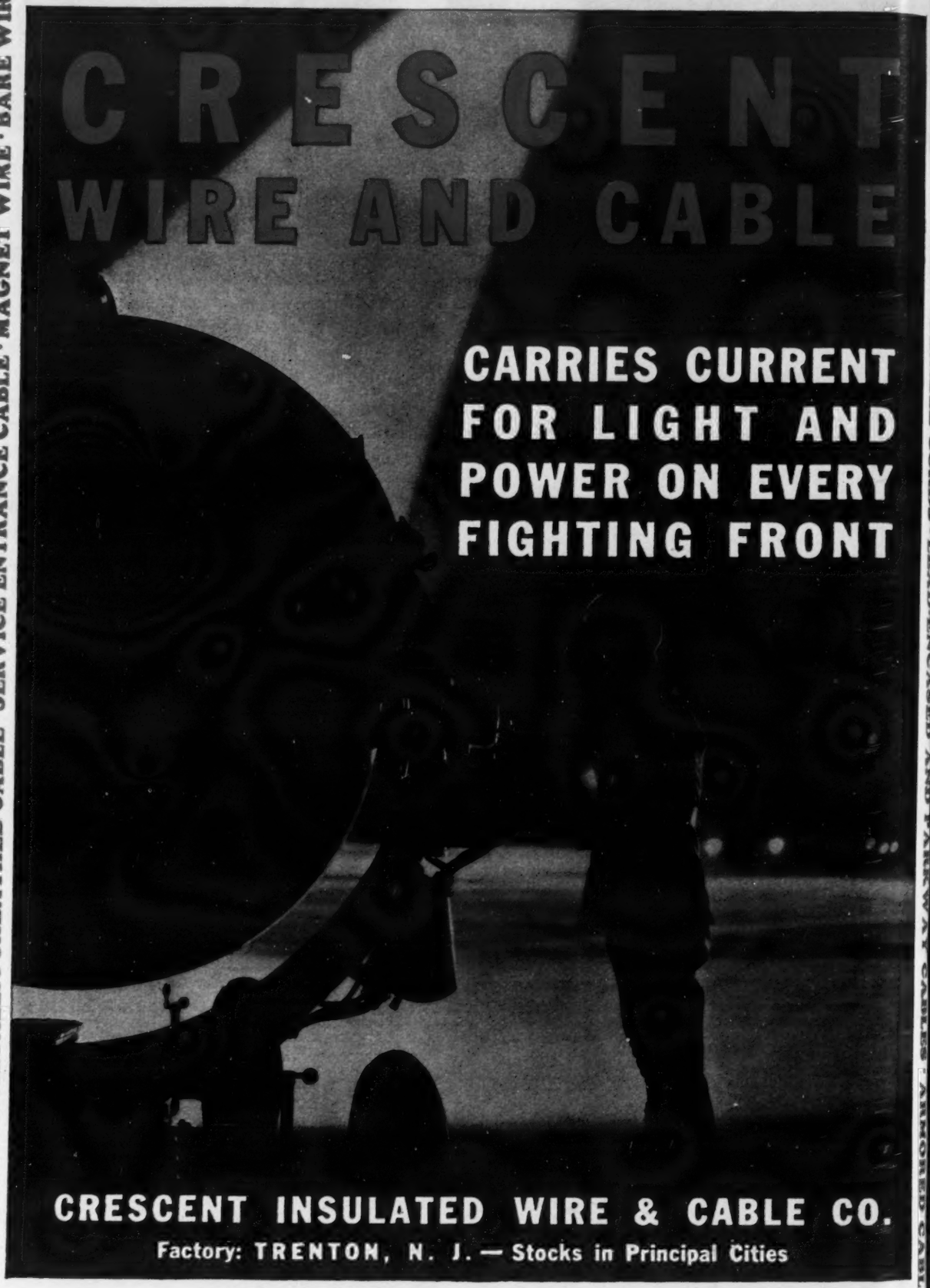


1,500 KVA, Type AT, OISC Power Transformer, three phase, 60 cycles, 38,060Y—2,300 volts. Sectionalized case—special accessories.

...mpany

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RAD

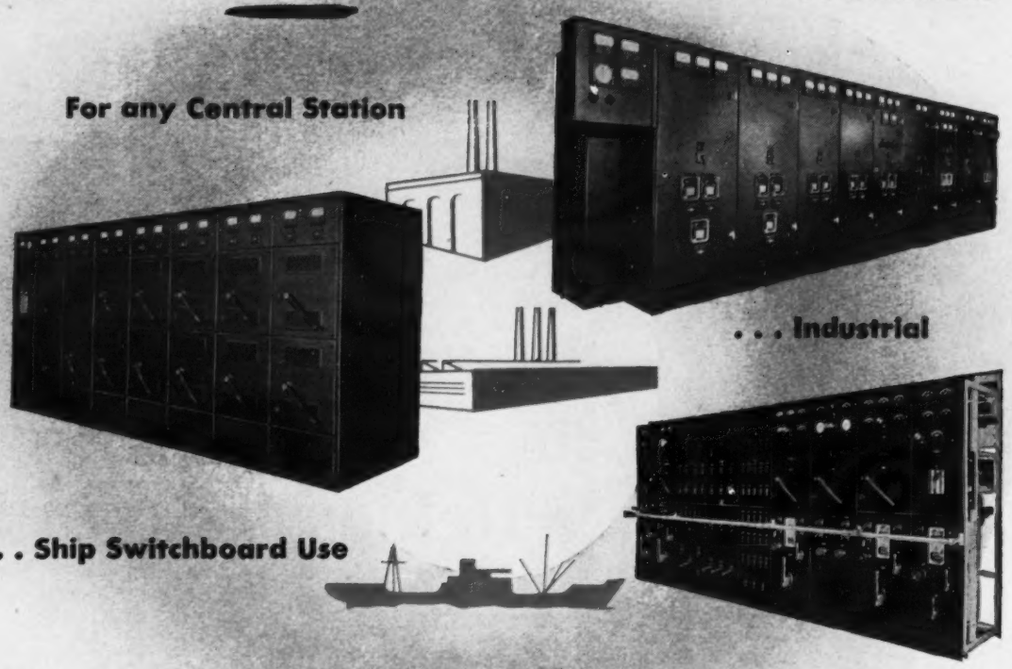
CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE



CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

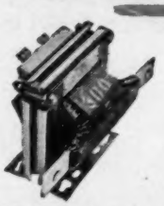
Your Best Bet—

TO GET THE RIGHT INSTRUMENT TRANSFORMER

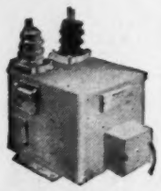


—select from the complete Westinghouse line!

Type CT Indoor Current Transformer for 5, 8.7 and 15-kv service built to the standardized EEI-NEMA dimensions and performance.

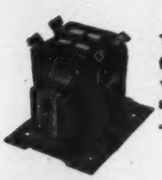


Type KO Indoor Current Transformer for 5,000-volt service. Dependable metering accuracy . . . lower burdens.



Type PT Indoor Potential Transformer. Primary rating 230 to 14,400 volts. High accuracy . . . heavy burdens . . . high impulse level.

Type VS Indoor Potential Transformer. Primary rating 230 to 2,300 volts. Metering accuracy . . . heavy burdens . . . small size and weight.



Type CV Indoor Potential Transformer. Primary rating 115 to 600 volts. New lightweight design . . . small size . . . high accuracy . . . heavy burdens.

Regardless of your requirements, you'll do better by standardizing on Westinghouse Instrument Transformers.

First, completeness of line assures your getting the *one* unit that meets your specific size . . . weight . . . mounting . . . burden limitations . . . with highest accuracy.

Second, you benefit from uniform standards of manufacture and performance.

Third, you realize tangible benefits from Westinghouse research and manufacturing experience on all types of transformers. The development of Hipersil steel, which carries ⅓ more flux with less weight, is a case in point.

Five units (as illustrated) meet 80% of all requirements, but many more types and sizes are available. See your Westinghouse Instrument Transformer Catalog No. 45-000 . . . make it your *standard* reference.

For Navy and other jobs requiring highly specialized units, Westinghouse furnishes Instrument Transformers built to specifications. Ask your Westinghouse Representative for details. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., Dept. 7-N.

J-70405

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INSTRUMENT TRANSFORMERS

Your Patience Helped Us Win the
ARMY-NAVY "E"

While the citation mentions only the management and workers of Crescent Tool, we could not help but think that there should have been a third representative on the platform when our "E" Flag was presented.

For without the patience and understanding of our old customers — Jobbers, Dealers and Users alike — we doubt if that flag of merit would ever fly over our plant.

To our good friends then . . . to you who have helped us build our business through good years and bad . . . we say: this is your honor as well as ours. The orders that were only partially filled, the deliveries that were slow and the correspondence that was answered tardily, all helped in giving the fastest possible service to the armed forces. The minute there is the slightest slackening in their need, we will again increase our efforts in your behalf. That, we are sure, is the way you want it done.

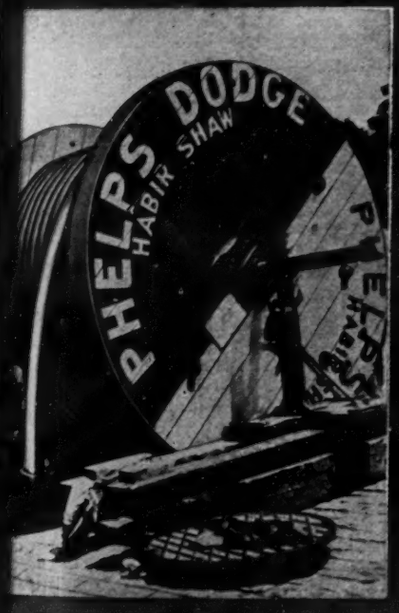
CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

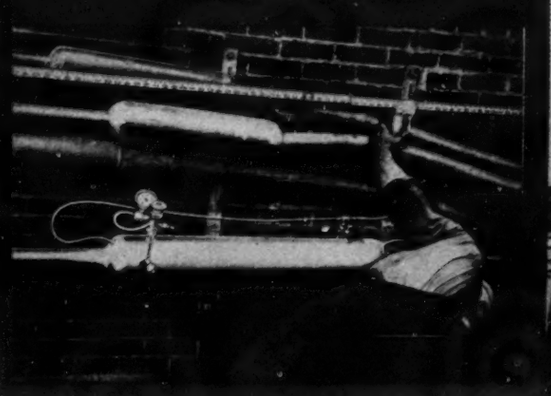
HABIRSHAW GAS-FILLED CABLE

OPERATING AT 38 KV AT NORFOLK, VA.

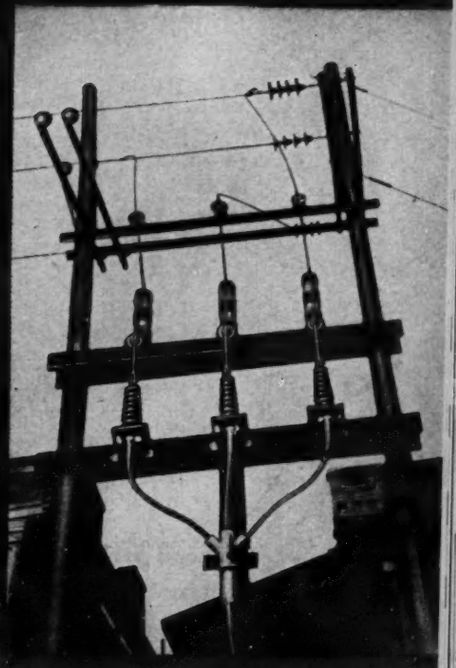
Three conductor, 600,000 CM compact sector,
330-mil impregnated paper, shielded.
141-mil copper bearing lead,
38 kv rating, 3.25 in. diameter.



Easy Installation



Simple Joints



Neat Terminals

PHELPS DODGE COPPER PRODUCTS CORPORATION

GENERAL SALES OFFICES: 40 WALL ST., NEW YORK

MILLS: Bayway, N. J. · Yonkers, N. Y. · Fort Wayne, Ind. · Los Angeles, Calif.

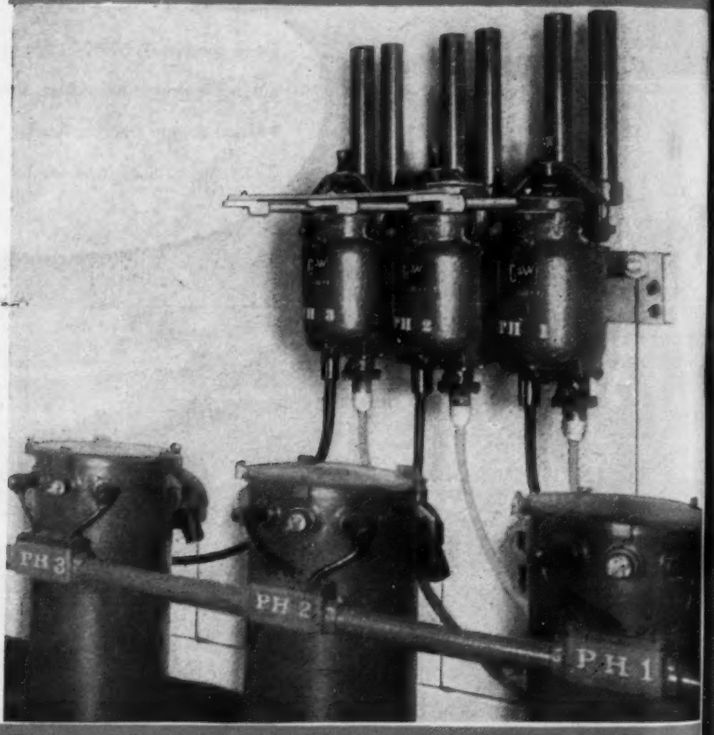
DO MORE with less!

THE G & W WAY

Here are two similar installations, one old, one new. There is no comparison in looks and there is no comparison in performance. G & W Oil Fuse Cutouts make it possible for you to do the job in far less space and with far less labor. They have the extra advantage for today of offering substantial savings of material. They reduce maintenance and they increase safety. But more important still, they give you a simple, fool-proof job that meets today's problems completely. They help you deliver the kind of service that is in demand today.

Let us send our new Bulletin #425 on this outstanding G & W Oil Fuse Cutout. Your request will bring it by mail.

Look how much better it can be done today — with a set of 3 gang-operated G & W Oil fuse cutouts for fuse-switch protection of the transformer bank. The cutouts are #FC 425P - 5000 volt, 200 ampere with three phase 60 cycle interrupting capacity of 50,000 Kva.



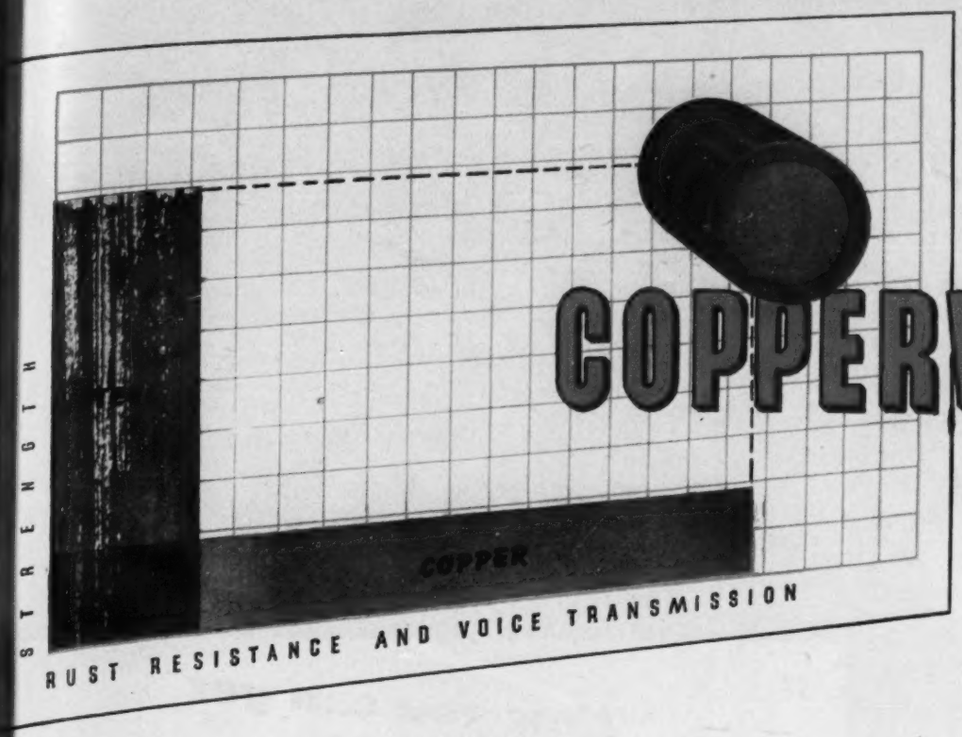
POTHEADS . . . UNDERGROUND CABLE BOXES . . . MULTITAPS
OIL FUSE CUTOUTS . . . SUBWAY OIL DISCONNECTS & SWITCHES

G & W ELECTRIC SPECIALTY CO. 7780 DANTE AVENUE CHICAGO, ILLINOIS

Also made in Canada by POWERLITE DEVICES, LTD., Toronto

HE STRENGTH OF STEEL--

THE CONDUCTIVITY AND PERMANENCE OF COPPER--



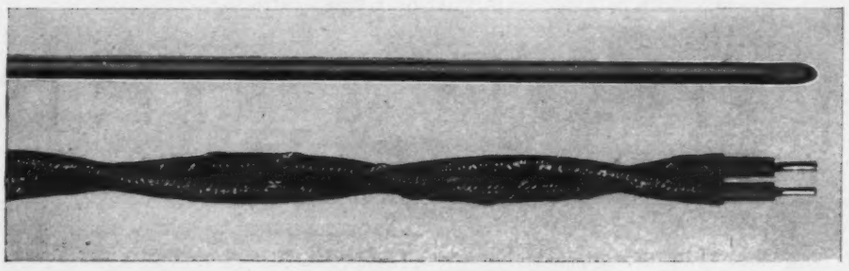
It's the combination of copper and steel in Copperweld that makes it the ideal wire where strength and permanently good voice transmission are required. Steel provides strength, but lacks rust resistance and electrical conductivity. Copper provides rust resistance and conductivity, but lacks strength. The best characteristics of both metals are united in Copperweld.

Copperweld Line Wires and Drop Wires resist rust like solid copper; both have high strength and provide permanently good voice transmission.

Copperweld Steel Company *GLASSPORT, PA.*

OPPERWELD LINE WIRE

OPPERWELD DROP WIRE



Now you can get K&M Ebonized Asbestos again!

Substitutes are no longer necessary . . . the *ideal* mounting for electrical installations is available again—K&M Ebonized Asbestos!

This is the *preferred* material for switchboards, bus bar runs, testing tables, panel boards and similar uses . . . preferred for the unusual sturdiness of its pressure-molded sheet construction . . . for its exceptional dielectric strength . . . for its ability to withstand severe shock, vibration and rapid temperature changes . . . and for its resistance to the effects of oil and moisture.

The demands of our armed forces and of many essential war industries have, heretofore, taken our entire output of K&M Ebonized Asbestos, even though production was considerably increased.

Now, having met many of these needs, we can supply you with K&M Ebonized Asbestos in thicknesses of ⅛-inch to 4 inches, with "standard" or special "panel" finish.

K&M Ebonized Asbestos meets the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

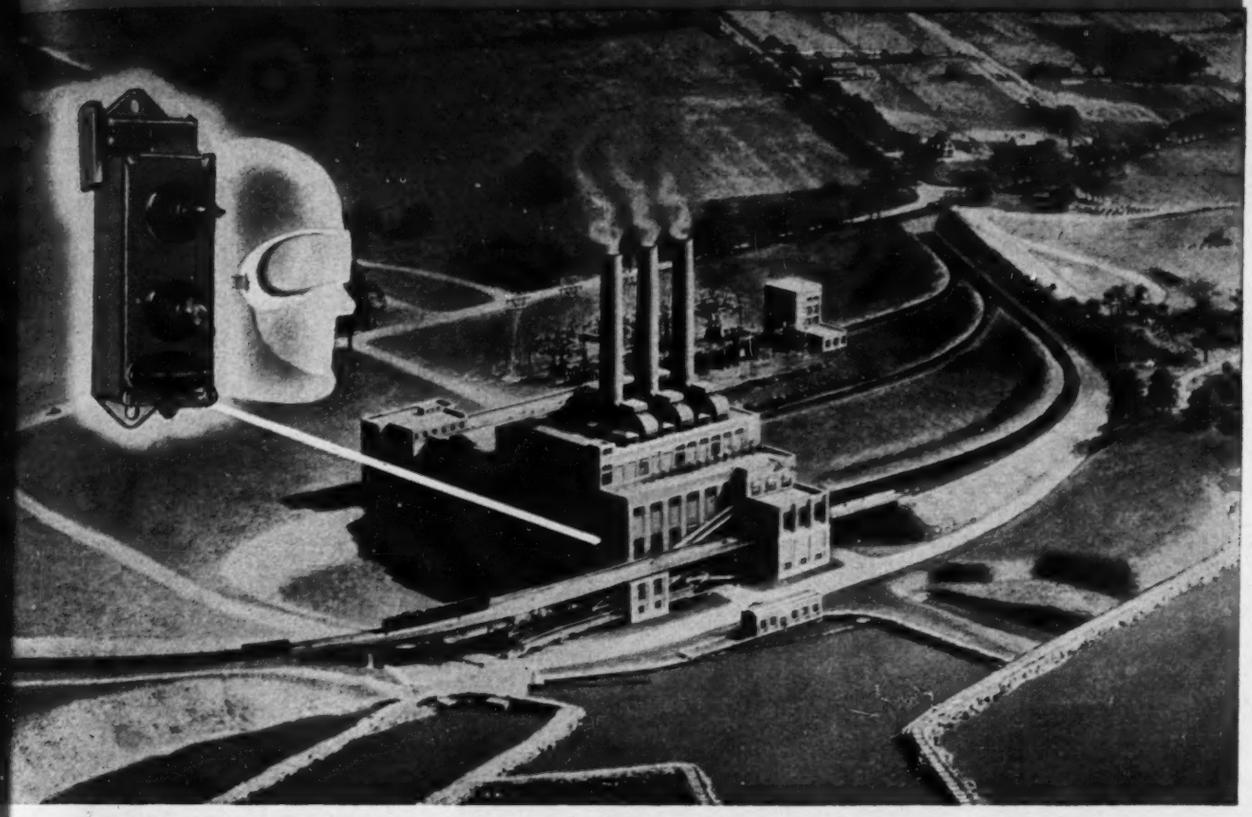
* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind . . . since 1873

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

★ Our Ambler plants proudly fly the Army-Navy "E" flag—an honor awarded K&M employees "for outstanding production of war materials."

The Lock that never "Forgets"



Safety rules are in force in virtually all Power Plants. Yet costly accidents frequently occur . . . very often because someone forgot!

So why not replace human frailty with mechanical infallibility? Install the Safety Men of "The Invisible Crew" . . . BENDIX-CORY* SAFETY INTERLOCKS.

These life and property saving units never forget. They make unauthorized access to dangerous equipment impossible. They keep such compartments or switches locked in use . . . or out of use . . . until the operator has complied with all of your safety regulations.

With BENDIX-CORY SAFETY INTERLOCKS you can interlock and safeguard any number of points. Write for full information. Let Bendix engineers help solve your problem.

*TRADE MARK OF BENDIX AVIATION CORPORATION

Products of this division are members of "The Invisible Crew"—precision equipment which 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

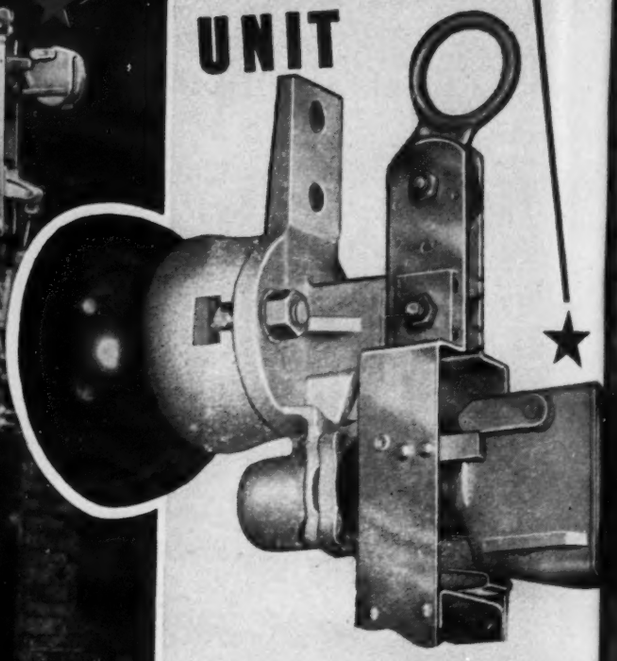
THE INVISIBLE CREW
Precision Equipment by
Bendix Aviation Corporation

BENDIX MARINE DIVISION • One Hanson Place, Brooklyn, New York

BREAKS LOAD SAFELY . . .

When the Main Switch Blade is opened, the current is Transferred to the

LOAD INTERRUPTER UNIT

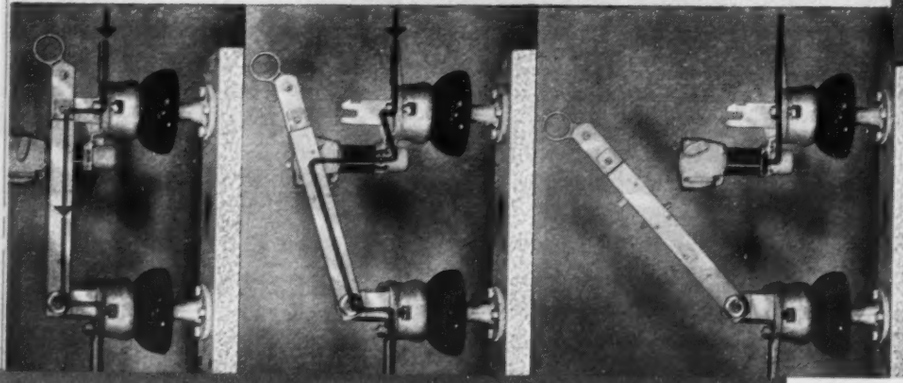


● The opening movement of the switch blade actuates the Load Interrupter Unit mechanism which clears the circuit without external arcing . . . in a cycle or less

1. Closed position of switch. As soon as blade is opened, current is carried through the Interrupter Unit.

2. As the blade is opened the mechanism in the Interrupter Unit is actuated to affect the separation of the interrupter terminals at high speed.

3. By the time switch blade reaches this position, safe air gap in circuit is established, eliminating possibility of leakage current between switch terminals.



S&C LOAD INTERRUPTER DISCONNECTS

Reduce Costs . . . Speed Installation

Use Them . . .

- For sectionalizing feeder circuits
- To disconnect capacitor banks.
- To isolate transformer banks.
- To isolate Industrial Plant feeders
- To interrupt exciting current of feeder regulators.
- As throw-over switches between preferred and emergency sources

AND WITHOUT ARCING
AT MAIN SWITCH CONTACTS

S & C LOAD INTERRUPTER DISCONNECTS
COST BUT LITTLE MORE THAN PLAIN DISCONNECTS

ou can now interrupt load currents up to 00 amperes at 15,000 volts safely—and with- t arcing at the main switch contacts with & C Load Interrupter Disconnects. And ese Switches cost but little more than plain sconnects.

They meet many load switching require- ents at substantial initial and maintenance vings over larger and more expensive cir- it breaking equipment. Space, weight, and stallation time are reduced.

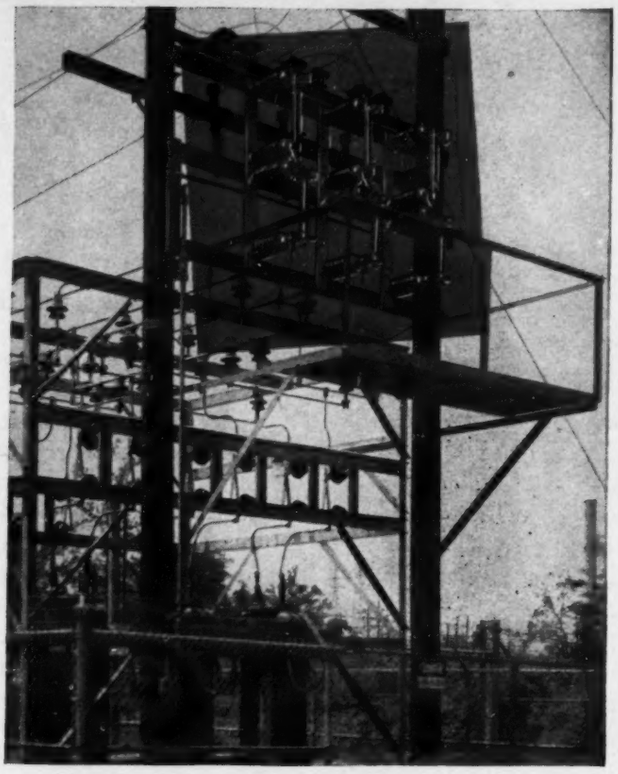
Further,—in combination with S & C Fuses, in the substation installation shown at right, th load switching and short circuit protec- n are provided. No horn gap or stick-opera- d Switches, as required for other circuit- eaking equipment, are needed.

Widely installed over a period of several years, performance records have been established which fully justify their use.

Specific uses for the Load Interrupter Switches and for Fuse Combinations are outlined on these pages...For what uses can you adapt them?

Use
INTERRUPTER SWITCHES AND FUSE COMBINATIONS

- **For substation feeder circuits.**
- **For branch distributing feeders.**
- **For high voltage switching and short circuit protection on primaries of industrial customer substations.**



FOR *New* SUBSTATIONS LIKE THIS...

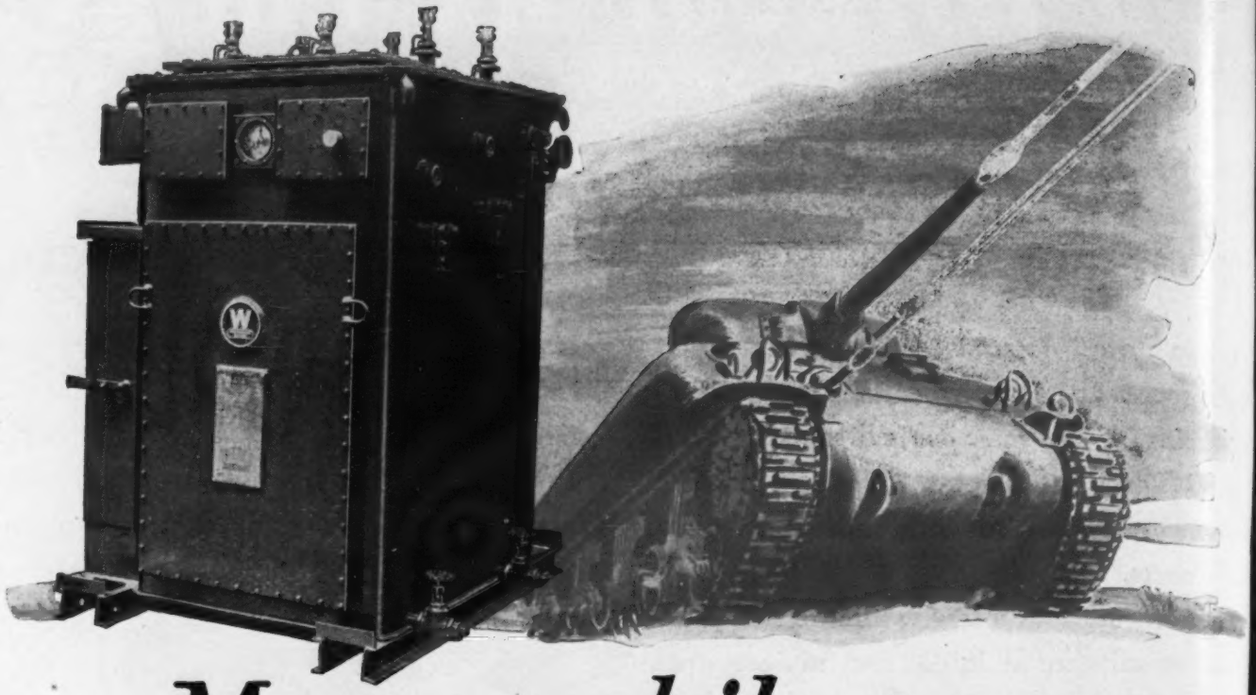
S & C Load Interrupter Disconnect and Fuse Combination on primary of three-phase stepdown transformer substation. Switch gang-operated handle located on pole near ground... The Heavy Duty Fuses have short-circuit interrupting ratings of:—20,000 r.m.s. amperes at 13,200 volts; 25,000 r.m.s. amperes at 6600 volts; 30,000 r.m.s. amperes at 2300/4000 volts.

MADE IN BOTH OUTDOOR AND INDOOR TYPES

WRITE FOR BULLETIN 202-A

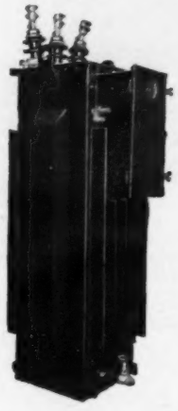
SCHWEITZER & CONRAD, Inc.

4435 Ravenswood Avenue, Chicago 40, Illinois



More mobile power

FOR THE INDUSTRIAL BATTLE FRONT



Westinghouse builds a complete line of feeder voltage regulators of all types and sizes. Liquid-filled step and induction regulators for indoor and outdoor service and natural air-cooled regulator for indoor service.

More tanks for Invasion Day is the goal of many a war plant—yet there is an earlier goal, even more important. Before tanks can be built the plant must have adequate electric power. Existing power sources must be expanded, or new transmission lines built.

That's where Westinghouse voltage regulators can play an important part in speeding the day of full-capacity production. They do the job simply, quickly, economically, and without using large quantities of critical material.

Typical example of what voltage regulation can mean is the case of a new war plant, built in the middle of a prairie, five miles from the nearest substation. It was a simple matter to tap the near-by 66 kv transmission line, but the power obtained was of little use unregulated. By use of a Westinghouse regulator proper voltage was maintained for the 5000 kv-a load with a saving of tons of critical materials and weeks of construction time.

Apply voltage regulators wherever practical to avoid construction of new lines, parallel lines and heavier lines. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. J-70418

WHY YOU NEED VOLTAGE REGULATION:

1. *Low Voltage Affects Motor Torque*—Motor starting torque drops off at a greater rate than actual voltage drop.

2. *Low Voltage Ups Motor Current Consumption*—Motors required to deliver rated output use more current if voltage falls off.

3. *Low Voltage Impairs Lighting*—Continuously good illumination depends primarily on proper voltage conditions.

4. *Low Voltage Interferes with P. F. Correction*—Any voltage drop sharply reduces the effectiveness of capacitors in correction of power factor.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Voltage Regulators

Gosh! Wasn't It Wonderful?

Those mash notes in high school days—remember? Wonderful, wasn't it? . . . Well (passing from the sublime to the commercial!) —you likely have pleasant recollections, too, of the durability of the Chromel-equipped heating devices on your line. Most of them are still in use, because their Chromel units last and last. Then, too, you know the durability of Chromel units in regard to your industrial heating load most of which provides vital heat-treatment in our war effort. Chromel elements are trustworthy for you and your customers. . . . Catalog-M (W) contains information useful to you. Send for a copy.

HOSKINS MANUFACTURING CO., DETROIT 8, MICH.

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

For almost three years Kelletts have been used on border patrol, covering up to 400 miles a day. A two-man team in a Kellett patrols a larger area more thoroughly than many men and much valuable equipment could do in any other way.

A Kellett rotary wing ship accompanied Admiral Byrd on his voyage to the South Pole

Eastern Air Line's Kellett flew mail for a full year from Philadelphia's Post Office roof.

Kellett looks forward enthusiastically to a future of expanding service to the nation.

PIONEERING NEVER STOPS
...not even for war!

Researching—engineering—and the commercial production of rotary wing aircraft have been Kellett's prime activities for over fourteen years. Tremendous strides have been made—and our work goes on, with efforts redoubled. Today, Kelletts are "earmarked" for the U.S.A.A.F. We can't give you the details now, but keep Kellett rotary wing aircraft in mind when you think of the future.

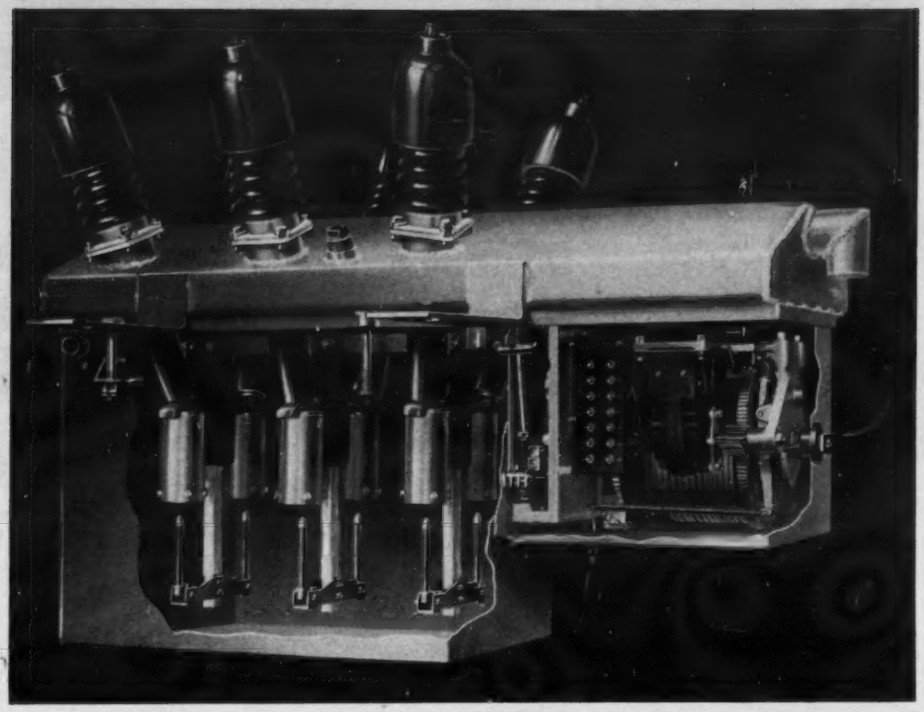
While we're cooperating with the Army in speeding the development of rotary wing aircraft, we're also supplying vital parts for many of our nation's best bombers and fighters . . . important work that requires highest skill and aircraft manufacturing "know how."

Kellett is looking forward to the time when this skill and experience can be turned to peacetime benefits . . . to provide you with Kelletts to cut time and costs in patrolling electric power lines, oil pipe lines, in transporting mail and passengers, dusting crops, and for other services to industry, commerce, forestry and agriculture. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

Clears any number of transient FAULTS



Type AP-40; 15-kv., 100-amps. Continuous; 1800-amps. Interrupting Rating, Pole Mounted.

PACIFIC ELECTRIC'S *MOTOR WOUND* . . . AUTOMATIC SERVICE RESTORER

proves fuse protection inadequate for important loads

Have you rural or other lines that need full protection?

You can clear immediately any number of transient faults with the pole-mounted Automatic Service Restorer—just as many utilities everywhere are doing. One user reports: 242 operations from one Restorer in 8 days without lockout—during a storm. What a headache if that line had been protected with fuses!

Automatically rewinding its spring-stored operating energy after each closing, you have enough stored energy for four circuit openings. Transient faults, therefore, can be cleared immediately in any number.

You get a choice of reclosing intervals; easy, positive, outside adjustment of inverse-time-delay trip mechanism; fast arc extinguishment which saves oil, saves maintenance.

Ask for Bulletin No. 79 which illustrates and explains in detail why this motor-wound spring - actuated Automatic Service Restorer offers safe, reliable clearance of any number of transient faults.

C. H. Cutter, 1015 Securities Bldg., Seattle, 1, Wash.
G. S. Kirkwood, 437 S. Hill St., Los Angeles, 13, Calif.
Filbert & Fredericks, 90 West St., New York, 6, N. Y.
J. E. Redmond Co., 444 W. Madison St., Phoenix, Ariz.
Northwest Supply Co., 909 East 2nd St., Butte, Montana
A. A. Marrs, 526 Dwight Bldg., Kansas City, Mo.

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

YANKS IN RIZE

SHELL INDUSTRIAL
HELPED TO WRIT
O

A REVIEW OF ACCOMPLISHMENTS

Behind those history-making headlines made on the battlefront during the past year are the men, tools, machines and materials that have built ships in a matter of days instead of months . . . produced guns, planes, and tanks in undreamed-of quantities. In there, pitching for a speedy Axis strike-out, are Shell Industrial Lubricants—a few of which are high-spotted here.

SHELL VIRGO OILS

This line of soluble metal working oils combines high cooling efficiency with good rust protection. Shell Virgo Oils can be removed with water, leaving the metal surface clean enough to paint. Their high wetting characteristics make them extremely economical to use.

SHELL CUTTING OILS

A complete line of sulphurized cutting oils and coolants, both transparent and dark, that have been largely responsible for finer finished products, less down-time, longer tool life, with increases in war production that astonished even veteran machine-tool manufacturers.

AMERICA'S WAR PRODUCTION SPEED

AxisFlank

NAZIS

WARSHIP

First Adva

LUBRICANTS THAT THE HEADLINES 1943

SHELL HYDRAULIC OILS

A line of rust-preventive oils for hydraulic and general industrial use. Another Shell first. Where moisture is a factor, the new Shell Hydraulic Oils, because of the special rust-inhibiting qualities built into them, will positively prevent rust from starting . . . and without the sacrifice of other valuable characteristics. They form a protective film that coats the metal, making it impervious to water and moisture. They also have superior oxidation stability, improved load-carrying capacity.

SHELL TURBO OILS

The first steam turbine oils to prevent rust, they combine these rust-preventive qualities with superior oxidation stability . . . a rare combination that turbine manufacturers and engineers said was impossible until the perfection of Shell Turbo Oils in 1941. Shell Marine Turbine Oils have been used by the U. S. Navy for more than a year in battleships, aircraft carriers, destroyers, cruisers and other units of the fleets.

SHELLDRAW COMPOUNDS

A line of drawing compounds that is helping steel, brass, copper and other metal working manufacturers and fabricators turn out better products faster. Shelldraw Compounds reduce die wear, improve finishes and maintain size tolerances by preventing excessive die expansion.

AHEAD ON SHELL INDUSTRIAL LUBRICANTS

SHELL

Think of Me

When you are thinking of materials to meet technical needs of post-war production don't let "newness" blind you to the virtues of proven things—not new. Take Mica, for example, as a material having properties so combined that for certain purposes no other material makes a satisfactory substitute—and in many instances no other material can even temporarily serve as a substitute. Mica is an electric insulator practically unaffected by heat and cold and is impervious to moisture and oil. It offers high resistance to friction wear and chemical action. It is literally true that without Mica vital electrical parts, in many appliances of peace and many implements of war, could not properly function.

Think of Mica and the properties of Mica in your post-war production planning—then think of Macallen and accept the cooperation of Macallen experience and Macallen engineers in fitting Macallen Mica to your needs.

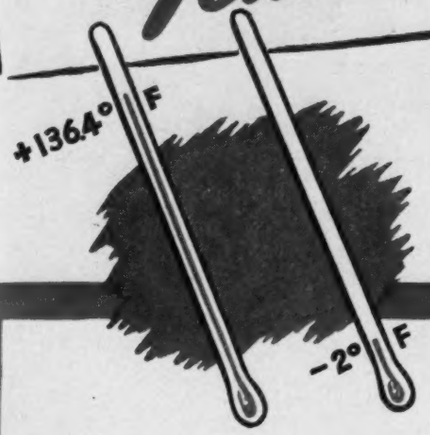
Send for our 50th Anniversary book "Macallen and Mica."

THE MACALLEN CO.

16 MACALLEN ST., BOSTON

CHICAGO: 565 W. WASHINGTON BLVD. — CLEVELAND: 1005 LEADER BLDG.

GIVE YOUR MOTORS THIS OVERLOAD PROTECTION *Today* ...TO ASSURE PRODUCTION *Tomorrow*



Extremes in ambient temperature do not affect the performance of the Thermaload V . . . because overload alone trips the Monitor *Compensated* Overload Relay. In tests at 600% heater rating . . . at the two extreme temperatures shown above . . . the tripping time varied only a few seconds. Your motors may never be subjected to such conditions but remember . . . even *normal* variations in temperature will affect the operation of thermal overload relays unless these relays are compensated. Play safe . . . specify the Monitor Thermaload V Solenoid Starter for original equipment and replacement.

The Monitor

THERMALOAD V

SOLENOID STARTER

The Monitor Thermaload V Solenoid Starter will provide the highest degree of overload protection available for your valuable motors. It will give the same full protection in hot, cold or changeable temperatures. It is designed so that careless or over-zealous operators cannot "block in" the reset button to prevent the trip. Shock-proof mounting separates magnet frame from base. Quality construction provides long life. Thoughtful design provides for easily-interchangeable coils for different voltages—quick replacement of double-break silver contacts.

Add these features up . . . consider Monitor's 55 year record of important contributions to precision motor control . . . and it is evident that for motors of up to 7.5 H.P., 110-550 Volts A.C. the Monitor Thermaload V is your best bet for overload protection.

At present—we can promise PROMPT DELIVERY FROM STOCK. Please comply with existing priority regulations when ordering.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE-2, MARYLAND

"Insulation Can Cover a Multitude of Sins"

—says *Romey

"All the materials that go into a Rome cable have to be good. We have a heritage to protect . . . a long recognized quality to maintain"... says Romey. "We roll our own copper rods, draw our own wire, do our own stranding and insulating. We watch every operation with an eagle eye because a cable is no better than its weakest spot.

"When we've filled an order and have it all packed for shipping, we know it's good because it's made of the right stuff—inside and out."

It has to be this way because our customers are our friends. We make friends with the quality of our products and the personal service we render.

We're looking forward to the time when we will again be free to supply you.

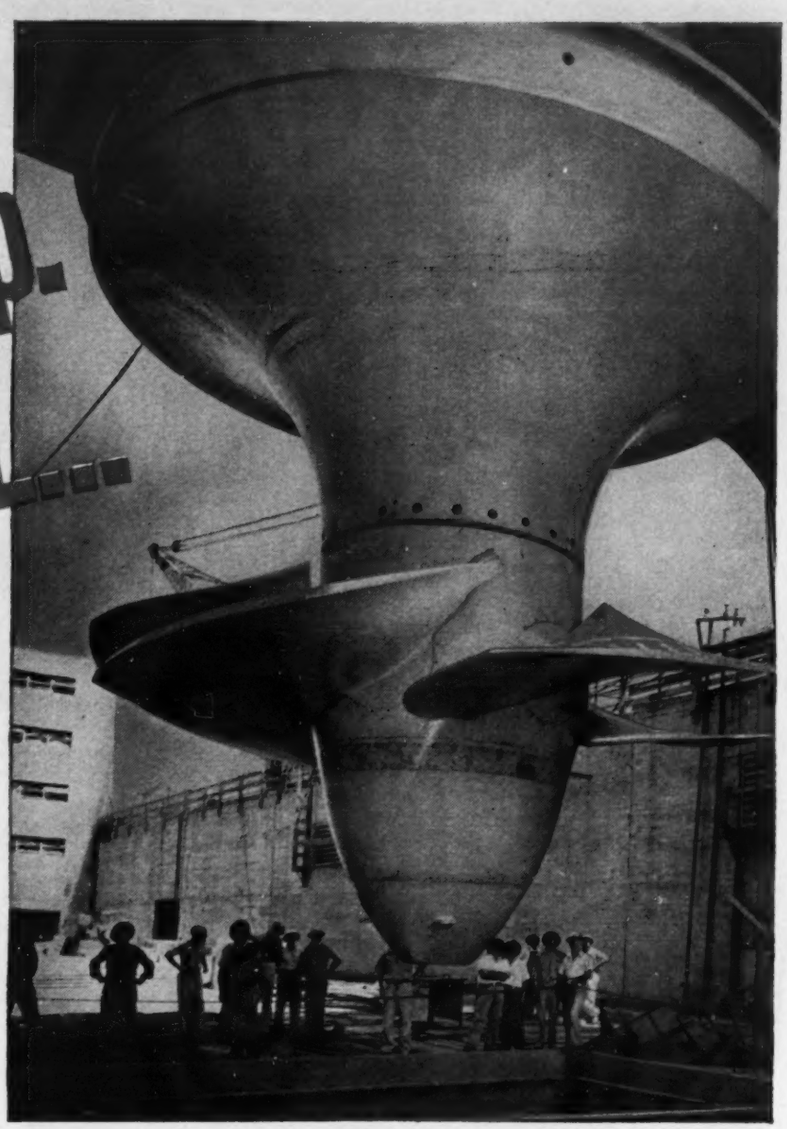
*Copr. 1943 RCC

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK

4,000 hp. PINWHEEL...



HARNESSED water power will drive this 218-ton giant... to produce 32,000 more kw. for America's war plants.

Mounting needs for electric light and power demand peak output from *all* turbo-generating equipment.

Texaco Regal Oils provide efficient lubrication for all types of turbines, both steam and hydro. Assuring normal bearing temperatures, *Texaco Regal Oils* keep governors instantly responsive to every load change. They keep turbine lubrication systems clean, rapidly free themselves from air and water, highly resist oxidation, gum formation, sludging. *They are rust and oxidation inhibited.*

A Texaco Lubrication Engineer is freely at your service through more than 2300 wholesale distributing points in the 48 States.

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

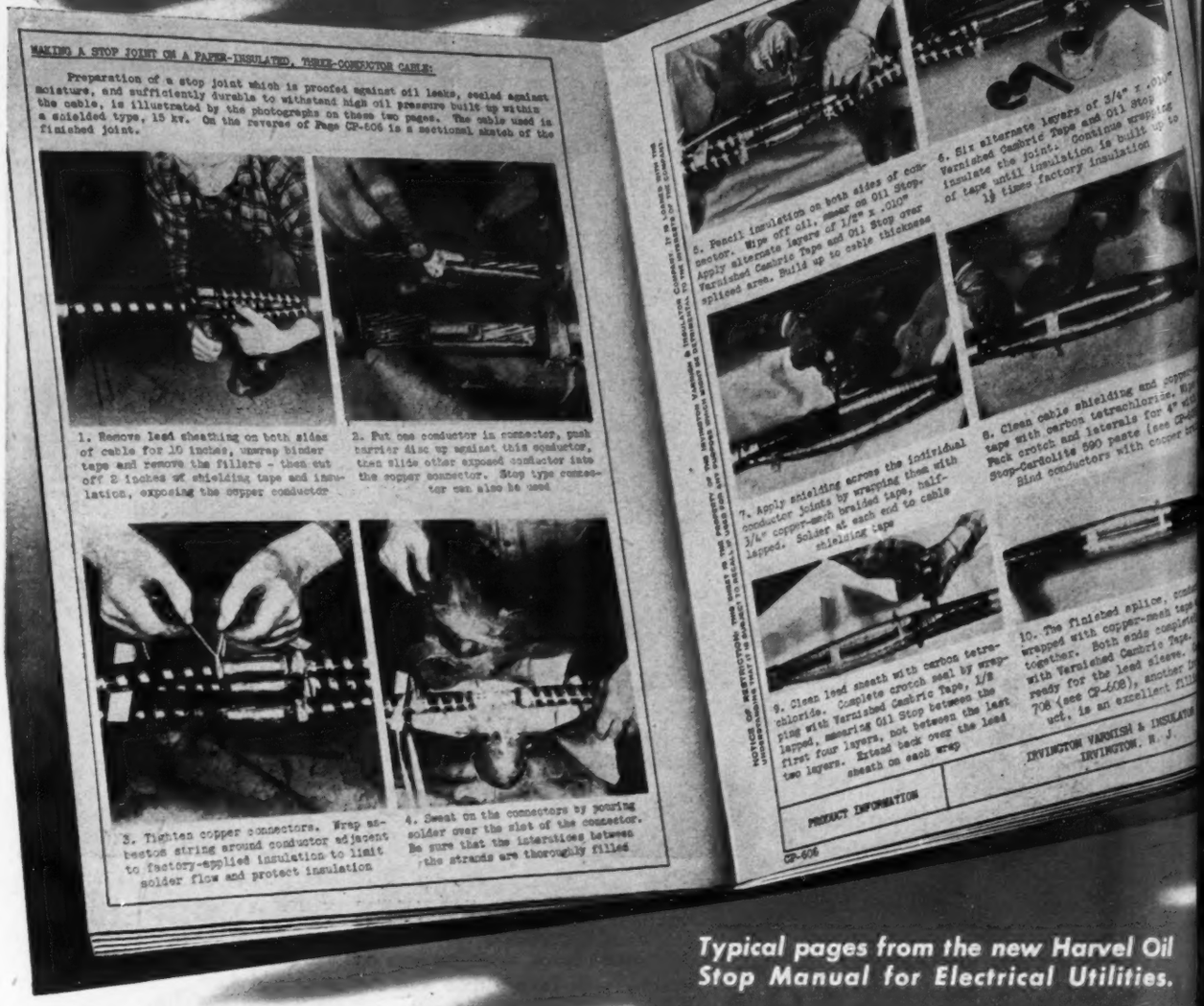
★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

TEXACO

TEXACO Regal Oils
FOR ALL TURBINES

NE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Making a STOP JOINT *on a paper-insulated cable*


MAKING A STOP JOINT ON A PAPER-INSULATED, THREE-CONDUCTOR CABLE:
Preparation of a stop joint which is proofed against oil leaks, sealed against moisture, and sufficiently durable to withstand high oil pressure built up within the cable, is illustrated by the photographs on these two pages. The cable used is a shielded type, 15 kv. On the reverse of Page CP-606 is a sectional sketch of the finished joint.
1. Remove lead sheathing on both sides of cable for 10 inches, unwrap binder tape and remove the fillers - then cut off 2 inches of shielding tape and insulation, exposing the copper conductor
2. Put one conductor in connector, push barrier disc up against this conductor, then slide other exposed conductor into the copper connector. Stop type connector can also be used
3. Tighten copper connectors. Wrap asbestos string around conductor adjacent to factory-applied insulation to limit solder flow and protect insulation
4. Sweat on the connectors by pouring solder over the slot of the connector. Be sure that the interstices between the strands are thoroughly filled
5. Pencil insulation on both sides of connector. Wipe off oil, smear on Oil Stop. Apply alternate layers of 1/8" x .010" Varnished Cambric Tape and Oil Stop over spliced area. Build up to cable thickness
6. Six alternate layers of 3/4" x .010" Varnished Cambric Tape and Oil Stop insulate the joint. Continue wrapping of tape until insulation is built up to 1½ times factory insulation
7. Apply shielding across the individual conductor joints by wrapping them with 3/4" copper-mesh braided tape, half-lapped. Solder at each end to cable shielding tape
8. Clean cable shielding and copper tape with carbon tetrachloride. Wipe. Pack crotch and laterals for 4" with Stop-Cardolite 590 paste (see CP-
Bind conductors with copper
9. Clean lead sheath with carbon tetrachloride. Complete crotch seal by wrapping with Varnished Cambric Tape, 1/8 lapped, smearing Oil Stop between the first four layers, not between the last two layers. Extend back over the lead sheath on each wrap
10. The finished splice, cont
wrapped with copper-mesh tape
together. Both ends complet
with Varnished Cambric Tape.
ready for the lead sleeve.
708 (see CP-606), another
uct, is an excellent fill
IRVINGTON VARNISH & INSULATOR
IRVINGTON, N. J.
PREFACT INFORMATION
CP-606

Typical pages from the new Harvel Oil Stop Manual for Electrical Utilities.

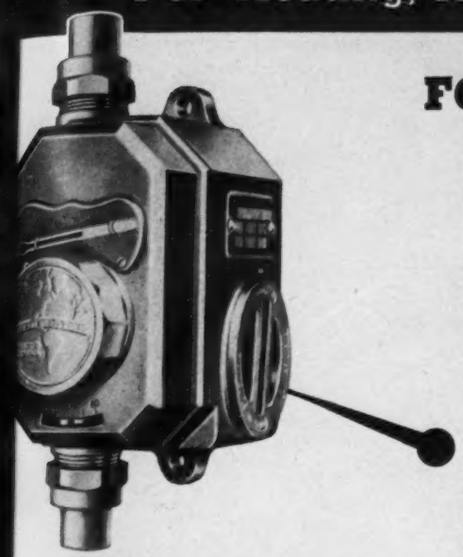
HARVEL OIL STOP, as used by leading utilities, provides an absolute oil seal on stop joints, splices, terminals and connections. These applications are fully described and shown in the new Harvel Oil Stop Manual by text and illustrations. Full details are given regarding the properties, versatility, methods of applications, tests and specific uses of Harvel Oil Stop.

IRVINGTON VARNISH & INSULATOR COMPANY
IRVINGTON, NEW JERSEY, U. S. A.
PLANTS AT IRVINGTON, N. J. & HAMILTON, ONT., CAN.
Representatives in 20 Principal Cities

SEND FOR FREE COPY of this generously illustrated, 16-page manual prepared especially for utilities engineers. It contains many helpful suggestions for making splices, stop joints and oil tight terminals that will reduce the cost of your operations, and will assure protection against electrical failures in cables where oil pressure is encountered. Write for this informative manual . . . TODAY. *Other Irvington materials used for splicing: Irvington Bias-Cut Varnished Cambric Tape, and Cardolite Nos. 590 and 708.*

IRVINGTON *Electrical* INSULATION

CROUSE-HINDS
Thermostat Condulets
For Heating, Air Conditioning, Refrigeration



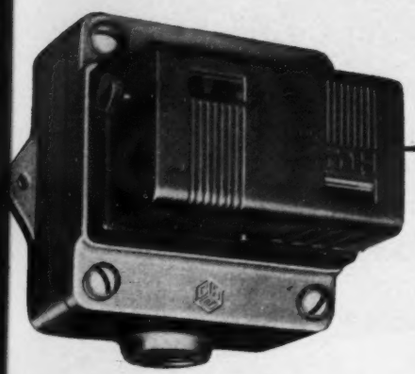
FOR HAZARDOUS LOCATIONS

Explosion-Proof and Dust-Tight—Suitable for use in atmospheres containing ethyl ether vapor; gasoline, naptha, petroleum, benzol, alcohols, acetone, lacquer solvent vapors and natural gas; metal dust; carbon black, coal or coke dust; grain dust; combustible fibers.

Type HRC

Mercury tube switch.
Threaded flame-tight cover.
Through feed ½-inch union hubs. Either hub can be capped.
Accurate thermometer for indicating room temperature.
Locking arrangement can be furnished to prevent regulating by unauthorized persons.

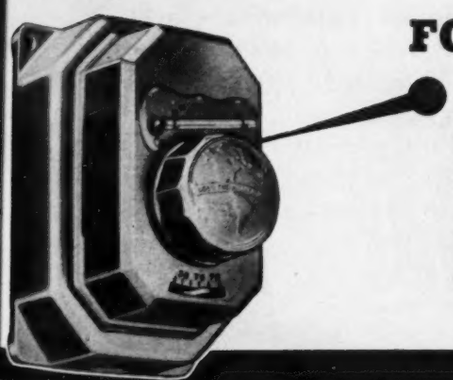
Listed in Condulet Catalog No. 2500, Section 85, Page 50-3.



Type HR

Contactor snap switch.
Ground surface flame-tight cover.
Reversible. ¾-inch hub can be at top, bottom, or either side.
Accurate thermometer for indicating room temperature.
Regulating knob removable to prevent unauthorized regulating.

Listed in Condulet Catalog No. 2500, Section 85, Page 50-4.



FOR NON-HAZARDOUS LOCATIONS

Type FHRC

Mercury tube switch.
Through feed ¾-inch hubs flush with top and bottom of body. Removable plug for either hub.
Accurate thermometer for indicating room temperature.
Locking arrangement can be furnished so thermostat can only be regulated by authorized persons.

Listed in Condulet Catalog No. 2500, Section 50, Page 22B.

A Nationwide Distribution Through Electrical Wholesalers

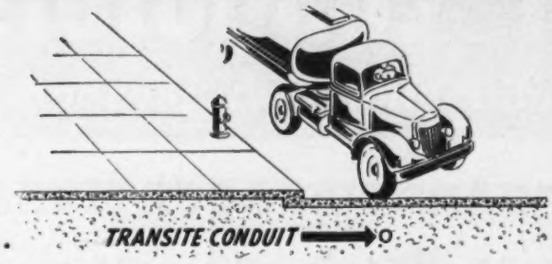
CROUSE-HINDS COMPANY
SYRACUSE, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington
Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans

CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

WHY *TWO TYPES* OF *TRANSITE DUCTS*?

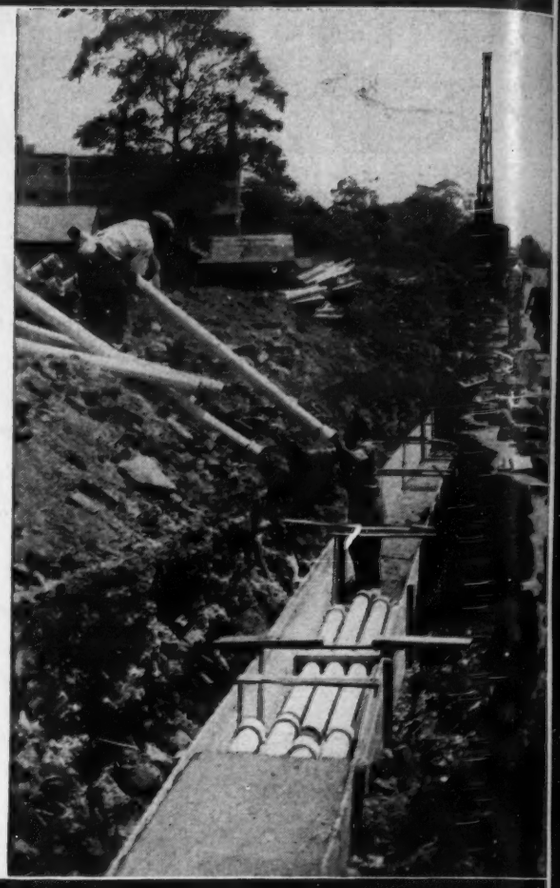
For Use Without a Protective Envelope . . .



Transite Conduit saves on labor and material, for it is so strong it needs no protective casing. It maintains its strength and true form under heavy earth loads and traffic pressure. Can't rot . . . effectively resists soil corrosion, smoke and fumes.

For Use With a Protective Casing . . .

Transite Korduct is thinner walled, lower priced, otherwise identical with Transite Conduit. Its long lengths mean fewer joints, fewer spacers. And its unusually high rate of heat dissipation lowers cable operating temperatures, boosts system capacity.



BOTH THESE DUCTS PROVIDE THESE ADVANTAGES AS WELL . . .

1. Minimize fire hazard—Transite Ducts cannot burn because they are made of asbestos and cement. They will not contribute to the formation of explosive or combustible gases.

2. Eliminate electrolysis problem—Inorganic and non-metallic, Transite Ducts can never be affected by electrolytic action.

3. Make cable pulls easy—The smooth bore of Transite Ducts speeds up cable installation. Because the ducts stay smooth in service, cables can be removed and replaced at any time with virtually no damage to sheathing.

4. Save time on installation—Light in weight, supplied in long lengths, Transite Ducts are so easy to assemble that only the minimum of time and expense is required for any job. Write for Data Book DS-410, Johns-Manville, 22 E. 40th St., New York 16, N. Y.

Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT— for installation in concrete

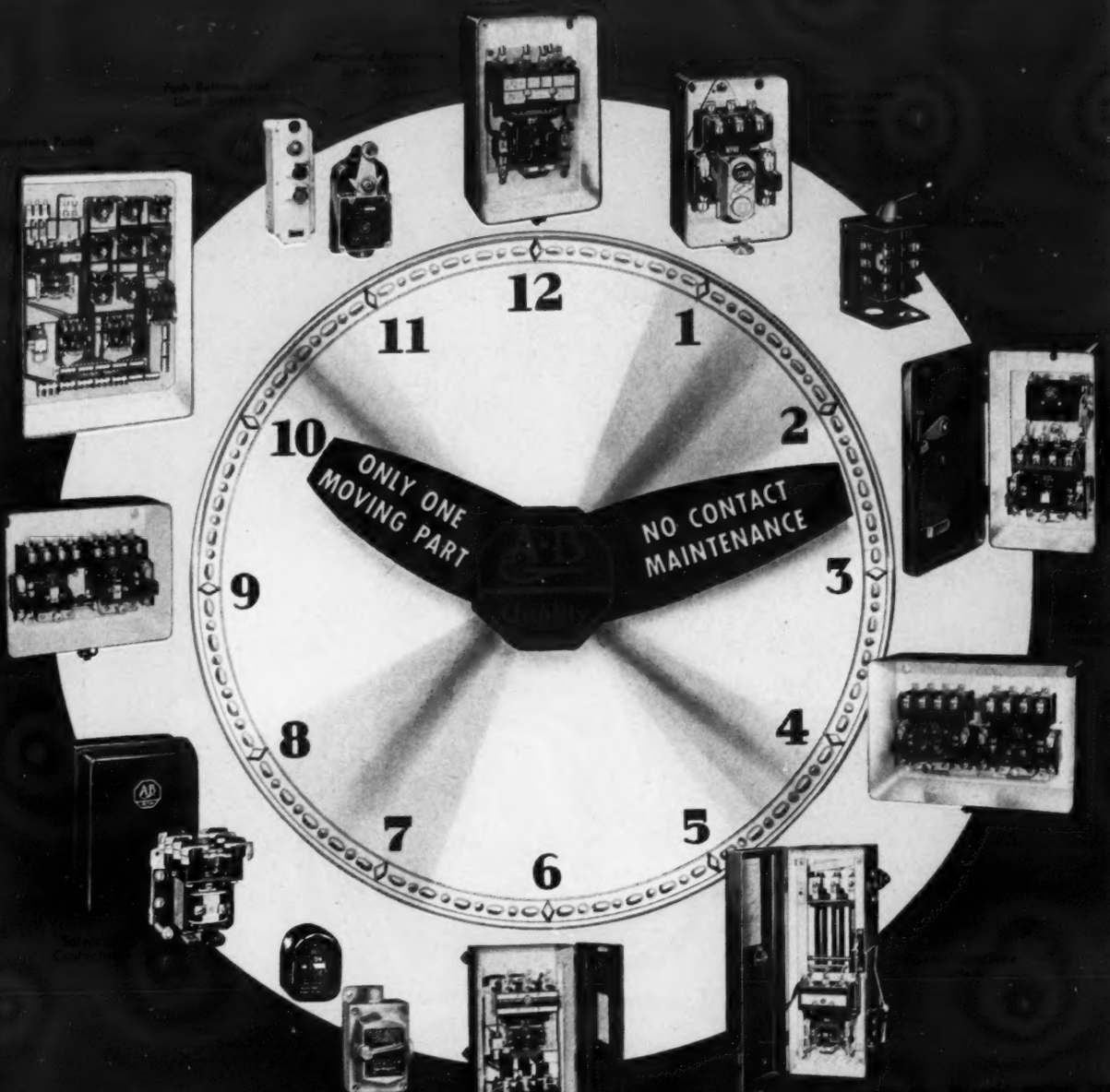
TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement

Cost More

ALLEN-BRADLEY

QUALITY

Around-the-Clock Production demands these trouble-free controls



ALLEN-BRADLEY

QUALITY

MOTOR CONTROL

In war or peace

B.F.Goodrich

FIRST IN RUBBER

Anatomy class in a rubber plant

lectricians' gloves improved by B. F. Goodrich developments

FOR years, electric linemen were handicapped in their difficult work t only by the fact that they had to ear two pairs of gloves but also be- use the rubber inner pair was stiff d hard to work in. Such gloves have ng been made by repeated dippings hand-shaped forms in rubber solu- ons until the rubber was thick enough provide the needed protection. But e dippings built up layers. And the ers made the gloves stiff.

The first real improvement came hen B. F. Goodrich developed the node process which made it possible to get the needed thickness with a *single* dipping in *pure liquid latex.* The stiffening effect of the layers was eliminated. Anode electricians' gloves were flexible; as a result seemed much lighter, made the lineman's job easier.

Then B. F. Goodrich research men took another forward step. They studied the anatomy of human hands. They made photographs, plaster models of hands in repose and hands at work. From these studies they made forms with scientifically *curved* fingers. Using these forms and the Anode process they made electricians' gloves that surprised even hard-boiled linemen who had never known such comfort and flexibility in rubber gloves, who discovered that B. F. Goodrich Curv-Flex gloves actually made their work easier.

The B. F. Goodrich representative near you will be glad to show you how these gloves promote comfort, efficiency and safety. Call him, or write *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich
Electricians' Gloves

Third of a series of statements about ETL *comprehensive services*

COMPREHENSIVE SERVICES IN PROMOTION OF GOOD QUALITY IN LAMPS AND LIGHTING

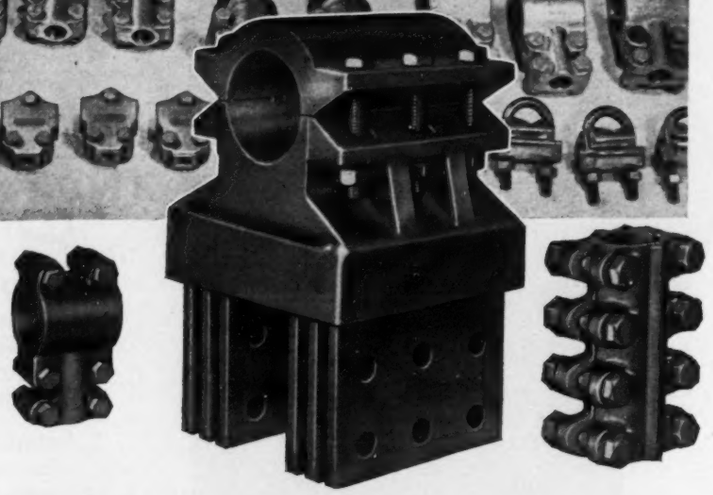
No form of examination has been devised that in newly completed lamps will infallibly detect every source of difficulty that may develop in service. For this reason ETL maintains inspectors in various parts of the country who follow the condition of lamps after shipment from factories; who observe the performance of lamps in service; who examine the condition of lamps returned from service; and who investigate conditions under which lamps operate. These experienced inspectors, graduates of the organization's work in lamp factories and at ETL headquarters, operating under close direction from headquarters, with the mutual aid that comes from exchange of experience in different parts of the country, render invaluable assistance in the effort of ETL in behalf of its clients to safeguard quality of lamps made by client manufacturers.

This is the third element of ETL's *comprehensive services* in connection with lamps and lighting. These inspections and investigations under service conditions attain to higher effectiveness than they otherwise could because they are coordinated with inspections and tests at the producers' plants and with testing and research at ETL headquarters.

ELECTRICAL TESTING LABORATORIES, INC.
2 EAST END AVENUE AT 79th STREET, NEW YORK 21, N.Y.

KEEP THE POWER FLOWING WITH

"THREE E" *Connectors*



★ Our *Bulletin #401* lists a large variety of couplers, parallel groove clamps, reducers, stud connectors, tees, terminals, etc. These are made for bar, tubing, wire, rod, and cable in the clamp, solder, or shrink fit style. We also list a complete line of expansion and ground connectors.

You should have a copy of this bulletin, it will be sent free upon request. If you do not find therein the type of connector you want, give us your specifications as we have excellent facilities for producing special types.

All connectors are made of high grade copper or copper alloy properly proportioned and accurately machined.

Whether your power connector requirements can be filled by standard fittings or necessitate special designs, such as illustrated by the large tee connector in the accompanying photograph, "THREE E" has it. The six copper bars are cast to the body of connector to obtain equivalent of one solid piece casting. This construction eliminates sweated or pinned joints. These connectors were made for an important job associated with the war effort.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

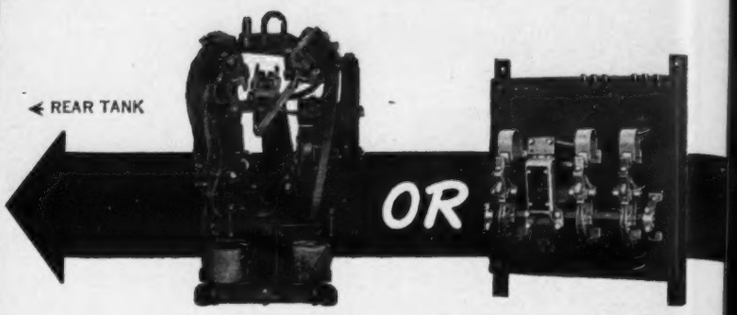
EC&M {OIL-IMMERSED / CUBICLE-TYPE} STARTERS

FOR 220-550 VOLT SYNCHRONOUS MOTORS

Companion Line to Bulletin 1076-A, Air-Break Starters

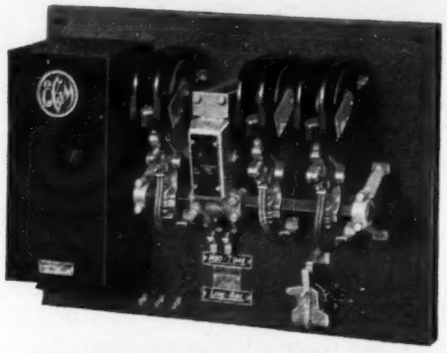
LINE AND FIELD AMMETERS
DOOR TO OVERLOAD RELAY COMPARTMENT AT RIGHT
EXCITER FIELD RHEOSTAT
FIELD-PANEL AND DISCHARGE RESISTORS MOUNTED IN THIS COMPARTMENT

STANDARD STARTER



At left above, is compensator-mechanism for reduced voltage starting and at right is contactor for full voltage starting. Depending upon the type of starter selected, one or the other of the above is mounted in oil tank at rear.

COMPLETE UNITS IN *Every* RESPECT



ELECTRONIC RELAY APPLIES D-C TO FIELD AUTOMATICALLY

View shows automatic field-panel which is mounted in lower compartment of front cubicle and is of tilting-panel type. Easily adjustable, electronic-type relay applies direct current to motor field to pull motor into synchronism automatically.

WITH all internal wiring complete and totally enclosed (NEMA Type I enclosure), these unit-type starters may be mounted out in the plant alongside the motors they control or in a separate control room.

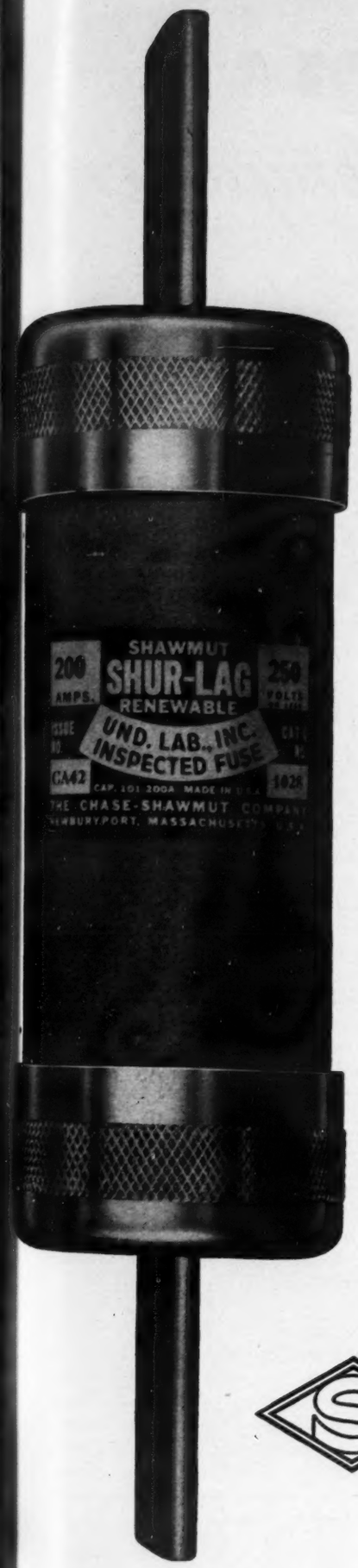
Arranged for two or three phase service. Maximum ratings—(reduced voltage) 150 H.P., 220 volts and 300 H.P., 440 and 550 volts—(full voltage) 400 H.P., 220 volts and 800 H.P., 440 and 550 volts.

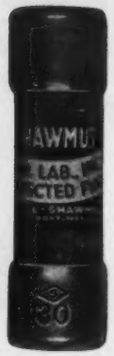
Standard features include equipment as illustrated above. Optional features include other NEMA Types of enclosures; voltmeter and other instruments; indicating light; field-removal and automatic resynchronization should motor pull out-of-step, etc.

Complete details given in Bulletin 1075-A. Ask for your copy to-day.

EC&M COMPLETELY AUTOMATIC — SYNCHRONOUS STARTERS

THE ELECTRIC CONTROLLER & MFG. CO., Cleveland 4, Ohio





FIFTY YEARS

OF QUALITY IN THE

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★ 1893-1943 ★

SHAWMUT IS

THE WORD

FOR FUSES

THE CHASE-SHAWMUT COMPANY

NEWBURYPORT, MASSACHUSETTS

See the new catalog of

MOSSMAN "Electrical Components"

Pictures and Describes Mossman Heavy Duty, Multiple Contact Switches Permitting Most Versatile Control Arrangements.

MOSSMAN Heavy Duty, Multiple Contact, Positive Action Switches have proven excellent components for indication in remote control or telemetering; supervisory control circuits in load dispatching; communication control circuits in utility and industrial plants; testing and calibration in meter departments.

Catalog is shown opened to the Mossman 4101 Lever Switch which can be secured in combinations as high as 12 springs per position, 24 springs per pile-up, or 48 springs total. Any combination of five basic contact forms may be built up to meet the required application.

The No. 4101 is a big, tough unit . . . once locked in place, all the jar and vibration in the world won't change its position. Constant adjustment is made certain by the heavily constructed chassis . . . a heavy brass frame, rigidly braced. This supports a chromium plated latch plate and spring actuated piston, in which a roller is mounted clevis fashion.

Standard heavy duty contacts are of 3/16" diameter fine silver—10 amperes, 110 volts A.C.—non-inductive. Extra heavy duty contacts are of 5/16" silver alloy—20 amperes, 110 volts A.C.—non-inductive.

The new Mossman Catalog is full of detailed drawings and data on the construction of the full Mossman line of electrical components which include many types of heavy duty, multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components. Write for it today.

DONALD P. MOSSMAN, INC.
6133 N. Northwest Highway, Chicago (31), Illinois

'S THE PORCELAIN THAT INSULATES

POTTERS' WHEEL: 1943. In the Lapp factory, a centuries-old technique in clay handling becomes a fundamental process in production of the world's most up-to-the-minute insulator. It may fairly be said that the Line Post owes its existence to the fact that Lapp clay can be handled by this throwing process. Here air-free clay is worked and reworked, refined and formed, preparatory to the Lapp dry-turning process. To know more about porcelain—and so to produce better porcelain—is the basis on which Lapp claims to produce insulators which will perform better on your lines. May we describe to you the many reasons behind this claim?

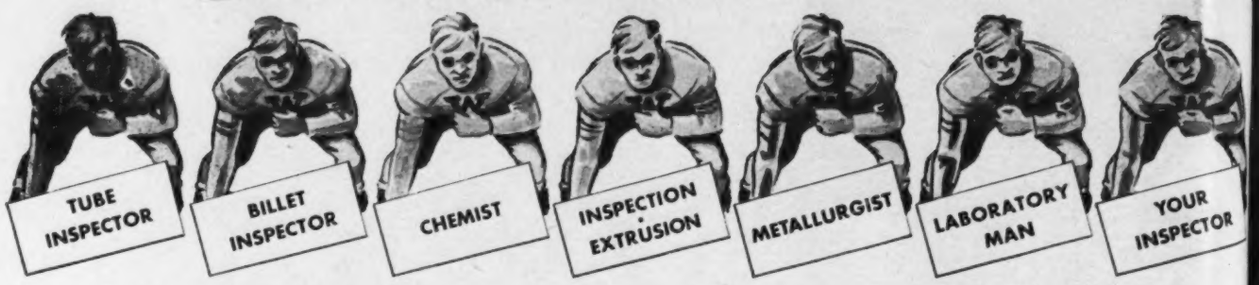
Lapp Insulator Co., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

No defective billet can crash this line



. . . that's why you can always depend on the uniform high quality of

WOLVERINE condenser tubes

Here's a line of real All-American caliber—a line that presents an impregnable defense to any defective condenser tube billet.

We call your particular attention to the center position, the Wolverine Inspection-*before*-Extrusion process. This player was developed by Wolverine, and is one of the most important members of the team. He plays in every game, every year.

His job is to watch for flaws *before* any billet enters the extrusion press. And if he finds a flaw—well, that billet is immediately thrown for a loss.

After years of developing and perfecting the extrusion method of making condenser tube, this Inspection-*before*-Extrusion is still the only sure way we know to guard against flaws entering the finished tube.

So if you want condenser tubes of high uniform quality,—quality that is now controlled from ore to finished product—put Wolverine on your schedule.

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY

WOLVERINE TUBE DIVISION

Seamless Copper — Brass

1427 CENTRAL AVENUE DETROIT 9, MICHIGAN

Never Before - A Motor Like This

WITH *Copperspun* ROTOR

Buy War Bonds

You've never seen a motor like this new Fairbanks-Morse Motor, because never before have so much stamina, versatility, and protection been built into one motor housing!

CHECK THESE POINTS . . .

✓ **1.** *40° C. Motor.* ✓ **2.** *Protected frame.*

✓ **3.** *Conduit box* has controls that give new meaning to "adaptable," "convenient," and "handy."

✓ **4.** Famous Fairbanks-Morse COPPERSPUN Rotor—the *ONLY* rotor centrifugally cast in *ONE* piece and of *COPPER.*

If you are buying motors now but want them to be up-to-date for postwar production, see this motor demonstrated. *There's no other way to appreciate how much more* it offers you! Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
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Motors

STRUTHERS-DUNN
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5,288 TYPES OF RELAYS

1321 ARCH STREET, PHILADELPHIA 7, PA.

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"Give us SLEEVING that's RUGGED..."

Operator at the Muskegon plant of Anaconda Wire & Cable Co. slipping Natvar sleeving on coil leads.

HAT was Anaconda Wire & Cable Company's first requirement for the eving to be used on coils they are building for certain vital war equipment.

"Give us sleeving that's rugged . . . it has to do more than pass the standard tests, because it will have to take plenty of punishment after it leaves here. We know where these coils are going . . . and we know *they've got to stand up!*

"And another thing — most of them are needed *yesterday*, so we're shipping 'em out each day as soon as they pass final tests. We run into trouble if the sleeving isn't smooth on the inside — it slows us down because most of our leads are dead soft or stranded. It may sound like a little thing — but it's important.

"Besides, we want fast color and fast delivery."

hat are *your* requirements? Write, wire, or phone us, and we will ship at ce, either from nearby wholesaler's stock or direct from our own.

Natvar

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
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- Varnished papers
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded Vinylite tubings
- Extruded Vinylite identification markers

Write for bulletins

THE NATIONAL VARNISHED PRODUCTS Corporation

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NATVAR: RAHWAY, N. J.

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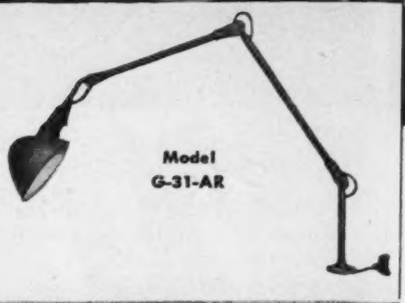
NEW! Westinghouse FOCALAIRE



For QUICKER Vision on Critical Work

Precision machine operations, close tolerance inspection and assembly work—all require quick, accurate vision that is only obtainable with high intensity, "Sharp Focus" lighting. Such illumination should be used to supplement good general lighting and provide from 100 to 300 foot-candles directly on the critical work area.

Westinghouse *Focalaire* units, for "close up" vision, are now available for practically every industrial application. All are sturdily built, extremely efficient in light output and easily directed on the work by simple adjustment of the ball-clip joints.

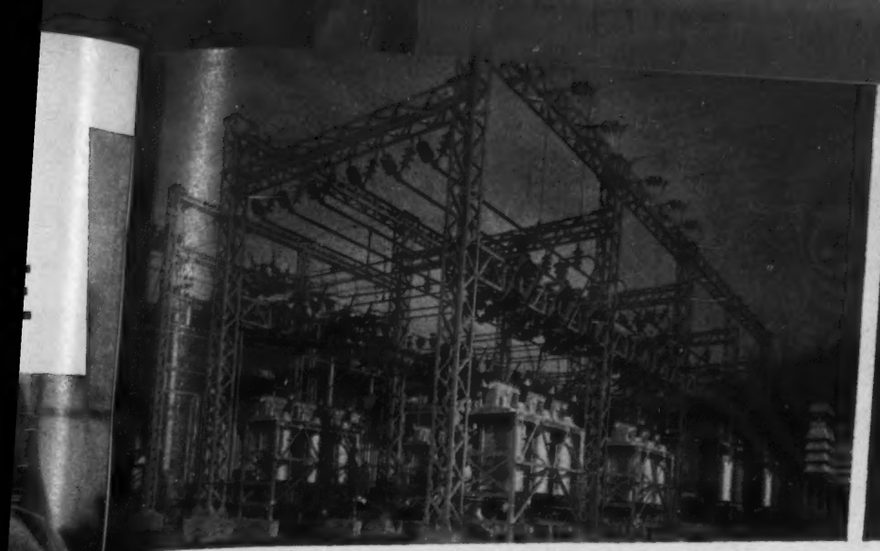
With many models to choose from, you can get the exact lighting you need. See your Westinghouse Lighting Representative without delay! Or write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio, for book B-3310.

CHOOSE FROM MANY MODELS

Westinghouse Focalaire Units are available with a wide variety of base attachments, supporting arms and reflectors. And you can select the exact combinations you wish.

You can have "Half" Reflectors, Angle Reflectors or Bowl Reflectors, as you desire. And supporting arms that range from 19 inches to 31 inches in length. Finally, 8 different bases cover practically every requirement.

Westinghouse
PLANTS IN 25 CITIES ... OFFICES EVERYWHERE
Lighting Equipment



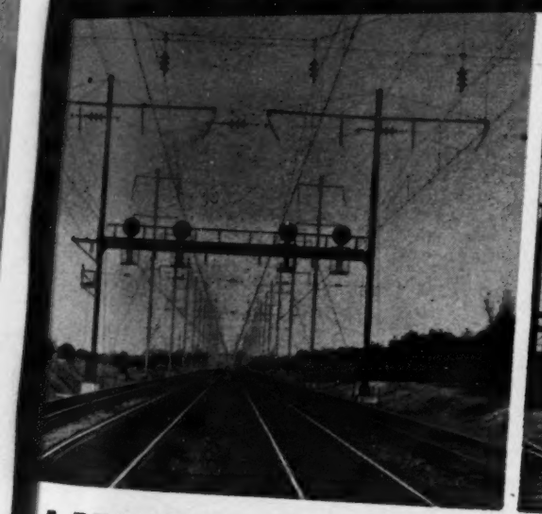
Engineering Resourcefulness

—a "plus" for your structural jobs

DURING the many years we have fabricated and erected steel structures for the electric power industry, one characteristic of American Bridge service has had more to do with the success of the jobs we have handled than anything else. It isn't a tangible factor. We can't write it into contracts. But every project benefits from it. You may have heard it called *engineering resourcefulness*.

What is this quality worth to you? . . . It means that every job American Bridge undertakes—whether it is the steelwork for a generating station, the towers for a transmission line, a substation structure, or an electrification project—will profit from an unsurpassed background of structural experience. It means that each project, no matter how large or how small, will receive the same painstaking care in planning, fabrication and construction.

Engineering resourcefulness gave our organization its worldwide scope of operation. This same resourcefulness now is enabling us to serve the war needs of our country in numerous ways, including even the manufacture of high-precision military equipment. We value this opportunity. But when peace returns, you'll find us "doing business at the old stand" as fabricators and erectors of structural steel, better prepared than ever to serve your post-war needs.



AMERICAN BRIDGE COMPANY

General Offices, Frick Building, Pittsburgh, Pa.

District Offices in: Baltimore · Boston · Chicago · Cincinnati · Cleveland
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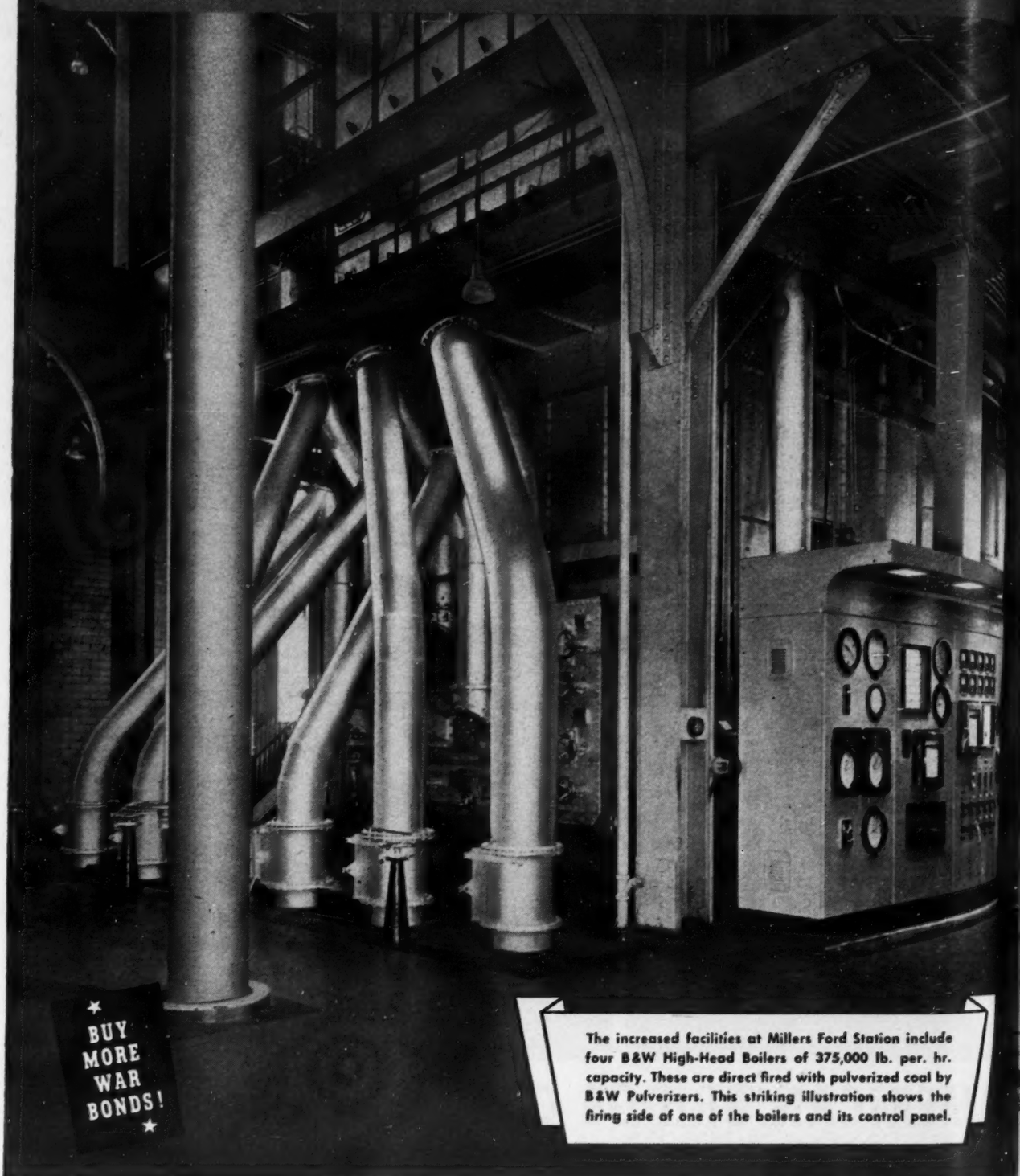
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL

VICTORY POWER...

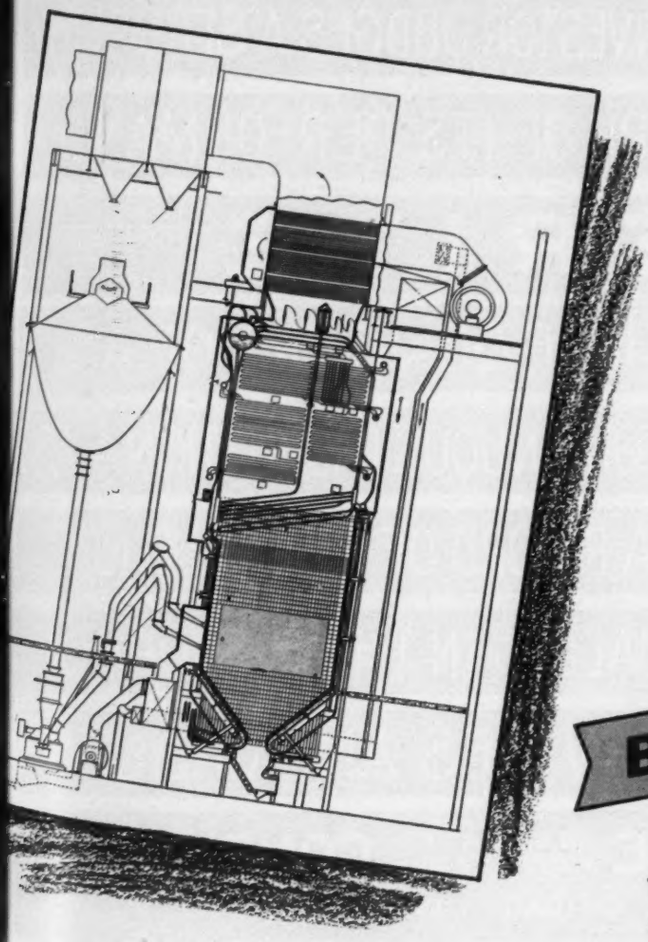


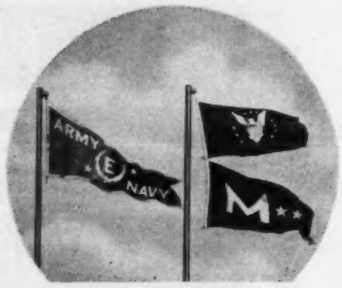
★ BUY MORE WAR BONDS! ★

The increased facilities at Millers Ford Station include four B&W High-Head Boilers of 375,000 lb. per. hr. capacity. These are direct fired with pulverized coal by B&W Pulverizers. This striking illustration shows the firing side of one of the boilers and its control panel.

...IS PLANNED POWER

The gigantic job being done by American power plants in supplying the electrical energy that drives the greatest industrial war machine the world has ever seen is evident in the almost incredible number of ships, planes, tanks, guns of all kinds, and other equipment being produced to defeat the Axis. And for this great surge of power, credit must be given to the public utilities, which had the vision to foresee an enormously increased demand for power and to have adequate facilities ready to meet it. Among these is The Dayton Power & Light Company, which increased the generating capacity of Millers Ford Station 70 per cent in the past five years to meet the requirements of an already heavily industrialized district. For careful and accurate planning, — "Well Done!" to The Dayton Power and Light Company and to all other power companies for their unceasing aid to the cause of the United Nations.

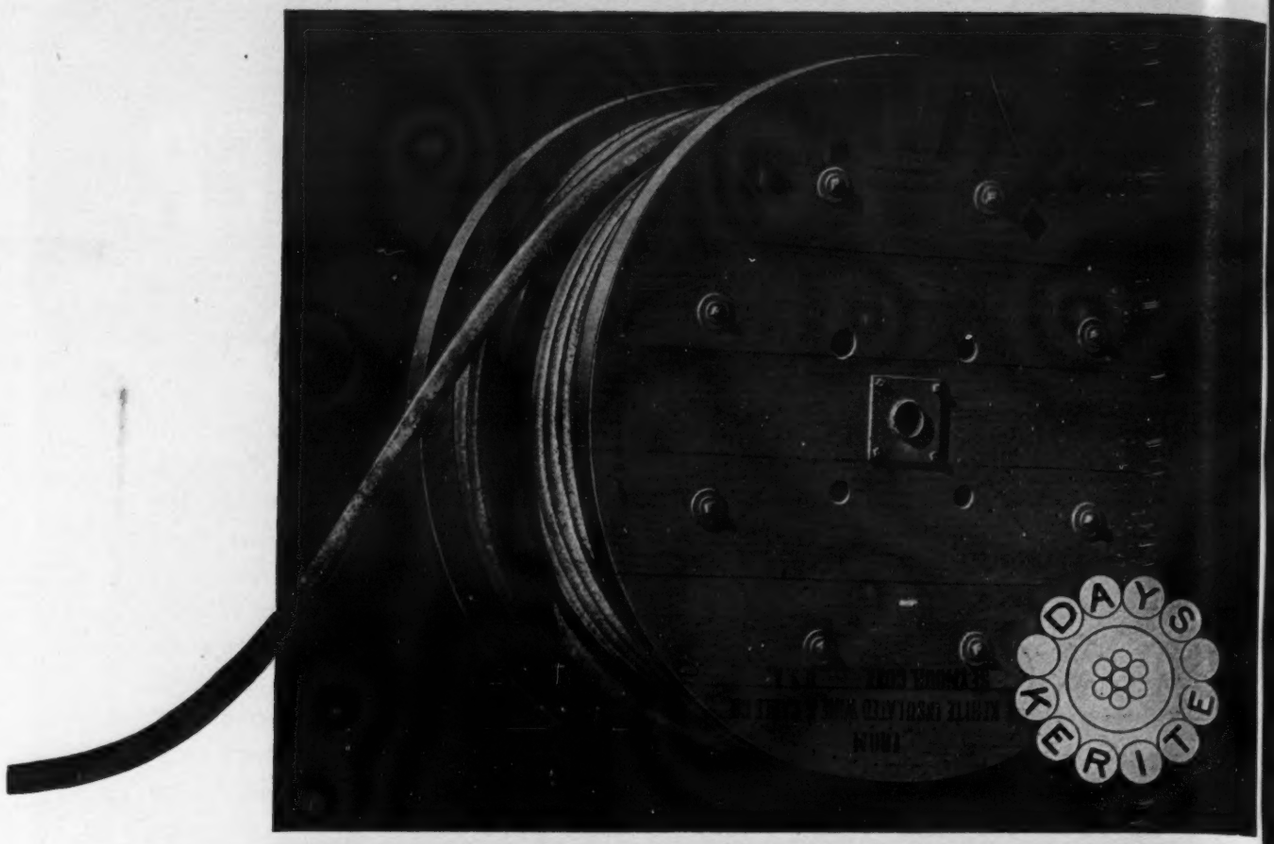




Army-Navy "E" flags have been awarded to four B&W plants, and also the Maritime Commission Award flags to the Barberton, Ohio, Plant.

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK 6, N. Y.



THE CAREFUL INVESTOR JUDGES A SECURITY
BY THE HISTORY OF ITS PERFORMANCE

KERITE

IN OVER THREE-QUARTERS OF A
CENTURY OF CONTINUOUS PRODUCTION HAS
ESTABLISHED A RECORD OF PERFORMANCE
THAT IS UNEQUALLED IN THE HISTORY OF
INSULATED WIRES AND CABLES

THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

Industry Organization

In the post-war planning by the electric utility industry attention is being paid to load and system planning and employment, but what, if anything, is being done about industry organization? In other words, how is it going to be possible to plan for industry action unless we know what kind of an organization will be available to do the job?

At the present time the industry luxuriates in four national organizations. It has the Edison Electric Institute, the Association of Edison Illuminating Companies, the Council of Electric Operating Companies and the group paying for the co-operative advertising program. While there may be good and sufficient reasons for the separate existence of all these national organizations at the present time, must we have all of them, or even most of them, after the war?

There are three big jobs to be done; one is the promotion of the use of electricity, another is the improvement of utility operations and the third is the education of public and employee in the benefits to be derived from private ownership and operation of utilities. All three jobs need national planning and direction. Can these jobs be done by one organization or is a separate association needed for each?

The promotion of the use of electricity is a bigger thing than just the utility industry. It affects the manufacturer, wholesaler, contractor and dealer vitally, and any promotional job that is tried which does not have the support of all these groups will operate at a disadvantage. Obviously, then, this market promotion job needs an organization that operates under the joint sponsorship of all groups. It does not need a separate utility organization.

The other two jobs—operations and education—need separate approaches, and while they can be combined within a single national organization, there may be some advantages in keeping them separate.

Operations, which means engineering, operating physical plant, sales and accounting, is pretty much the same regardless of ownership. The publicly owned properties and the privately owned companies have mutual problems and there might be many advantages in having the two ownership groups work together in this noncontroversial field. Some of the obvious benefits are standards of equipment performance, relations with manufacturers, standards of practice, market research and load studies. There are also the advantages that come from just working together. And, finally, there is the very great benefit to be derived from a membership that is representative of the entire industry.

The educational program, of course, involves only the privately owned companies. One essential part of that program, advertising, has in two years made a splendid start, but it still lacks a sponsor organization. With all kinds of public information, including the advertising program, tied together with employee information and education into one sponsor organization, the utility industry would have something on which to build solidly for the future.

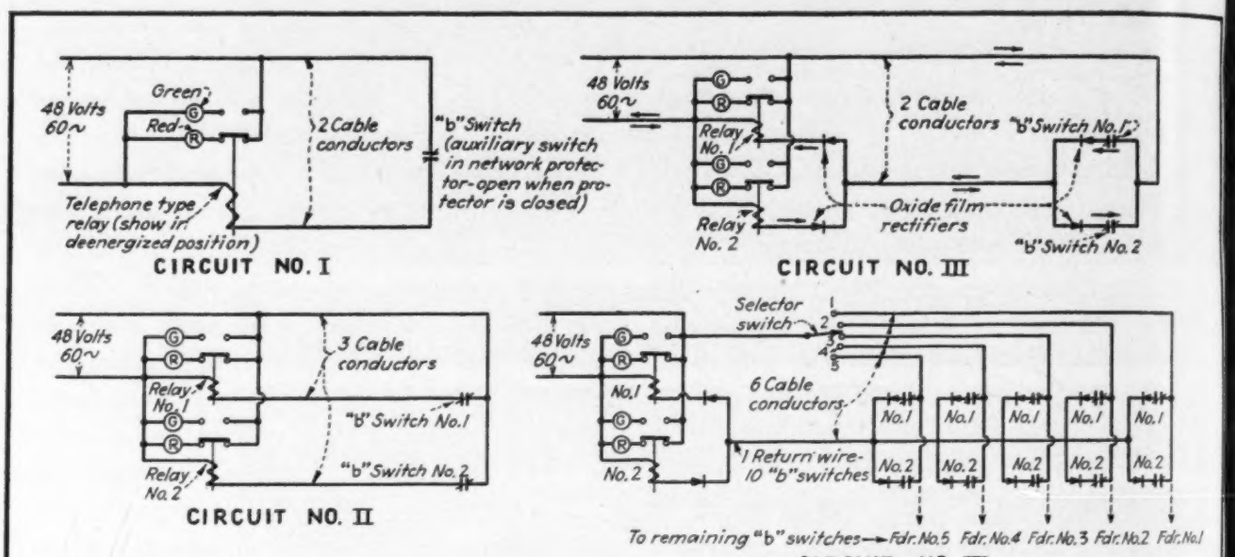
Such an industry organization set up as is here suggested, while different from what we have, would not necessarily mean scrapping everything, for many of the elements that would be needed are at hand and could be used in a reorganization.

Certainly, something of this nature must be considered if successful national direction is to be given to the industry's post-war plans.

Network Supervisory System Guides Test and Maintenance

Simplified, low-cost network supervisory system gives selective indication of open or closed position of 64 protectors on Oklahoma City network using thirteen conductors of eleven-pair telephone cable

JOE L. BARKER, Oklahoma Gas & Electric Company, Oklahoma City



JUDICIOUS CIRCUIT DESIGN reduces number of conductors required for supervision to a minimum; diagrams show steps in evolution of final circuit

BY ELIMINATING some of the elaborate features usually incorporated in such schemes a simplified network supervisory system has been evolved for the Oklahoma City low-voltage underground network which, while not original in fundamental design, is believed to be unique in its application.

On the Oklahoma City network, which is served by five 13.8-kv. primary feeders, this supervisory system provides selective indication of the position of 64 associated network protectors. The indication is given at the network operating center over thirteen conductors of an existing eleven-pair telephone cable.

Economic feasibility of the system is evidenced by the reduction it has effected in the cost of maintenance and operation of the network. Prior to its installation weekly tests of each 13.8-kv. network feeder, for reverse current operation of protector relays, required 2½ to four hours. These same tests are now completed in less than five minutes, if no network protectors fail to function.

The supervisory system was designed with the following requirements in mind:

1. To provide at a central location positive, instantaneous indication of the open or closed condition of each feeder network protector.

2. To be capable of expansion at reasonable cost to take care of additional network protectors as required.

3. To be simple, economical and reliable.

Periodic inspection, maintenance and electrical test of network protectors has been considered fundamental on the Oklahoma Gas & Electric system. However, as the underground system grew, this operating policy caused increased work and increased driving in downtown street traffic. The complete replacement of older types of solenoid-operated protectors with more modern units has eliminated the need for routine inspections and maintenance. Test in-

ations at the central control panel the new supervisory system are w used as a guide in determining need for protector maintenance l provide the system dispatcher h accurate information for control primary network feeders.

Operating Features

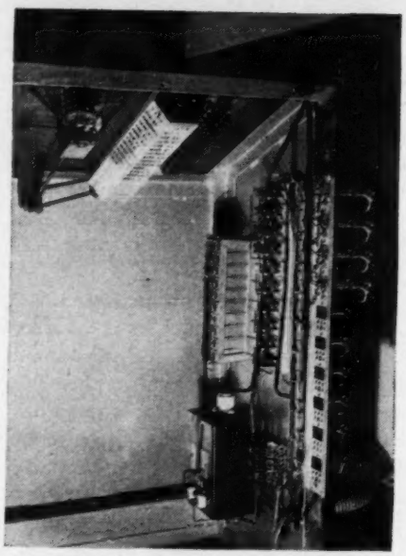
The new supervisory system was signed around an existing eleven-r telephone cable that connects all twork transformer vaults with the oint of switching control of the 8-kv. primary network feeders. e system has several unusual fea-res.

1. It indicates, almost instantly, ch network protector's open or sed position, time lag being that quired to pick up or drop out a phone relay.
2. Individual indications are ob-ned on a total of 64 independent itches by using only thirteen con-tors of the telephone cable.
3. Simple 60-cycle circuits and nventional electrical equipment re used.

Supervisory control panel and binet, shown in the accompanying ustration, are located at network erating headquarters near the itch control panel for the 13.8-kv. twork feeders. Provided on the pervisory panel are a master itch, ground detector switch with dicating lamps, a six-position ro-y selector switch (one position for h 13.8-kv. feeder and an "off" sition) and a double row of red d green indicating lamps. A six-ed drum, geared to the selector itch, is adjacent to the indicating mps. This drum rotates to bring e side flush with the panel surface each position of the selector itch. Each side so exposed carries ist of transformer vaults connected the 13.8-kv. network feeder indi-ed by the selector switch.

When an operator desires to check reverse current operation of pro-tor relays on a given feeder he es the master switch, turns the ctor switch to the position of the ired feeder, thus exposing the nsformer vault designations cor-ponding to that feeder on the m. Either the red or green indi-ng lamp opposite each vault desig-ion on the drum will glow, depend-ing on whether the network protector in that vault is closed or open.

With a primary feeder energized, all protectors on the feeder will nor-mally be closed and the red lamps should glow. To check reverse cur-rent operation of protector relays the operator trips the primary feeder oil circuit breaker. Transformers and



SUPERVISORY CONTROL PANEL and cabinet adjoins network feeder control board at operating center—(above) top view, (below) rear view of opened supervisory panel and cabinet

primary cable on that feeder are then energized by backfeed from the sec-ondary network bus. This reverse current flow through the network protectors causes their trip circuits to close and the protectors to open auto-matically. Any protector failing to open is immediately known, since the corresponding indicating light on the supervisory panel will not change from red to green as it should. Time lag of the protector on opening gives the operator an indication as to pro-tector relay adjustment and opera-tion.

On reclosing the primary feeder oil circuit breaker individual protectors close and panel-indicating lights change from green to red. Protectors that fail to close or that "pump" and the time required for any protector to close are immediately indicated.

In the course of regular network operation if a fault occurs on any primary feeder the 13.8-kv. oil circuit breaker trips automatically. The op-erator then can use the supervisory system to check that feeder position and verify the proper opening of all protectors on it, or locate any pro-tector which fails to open.

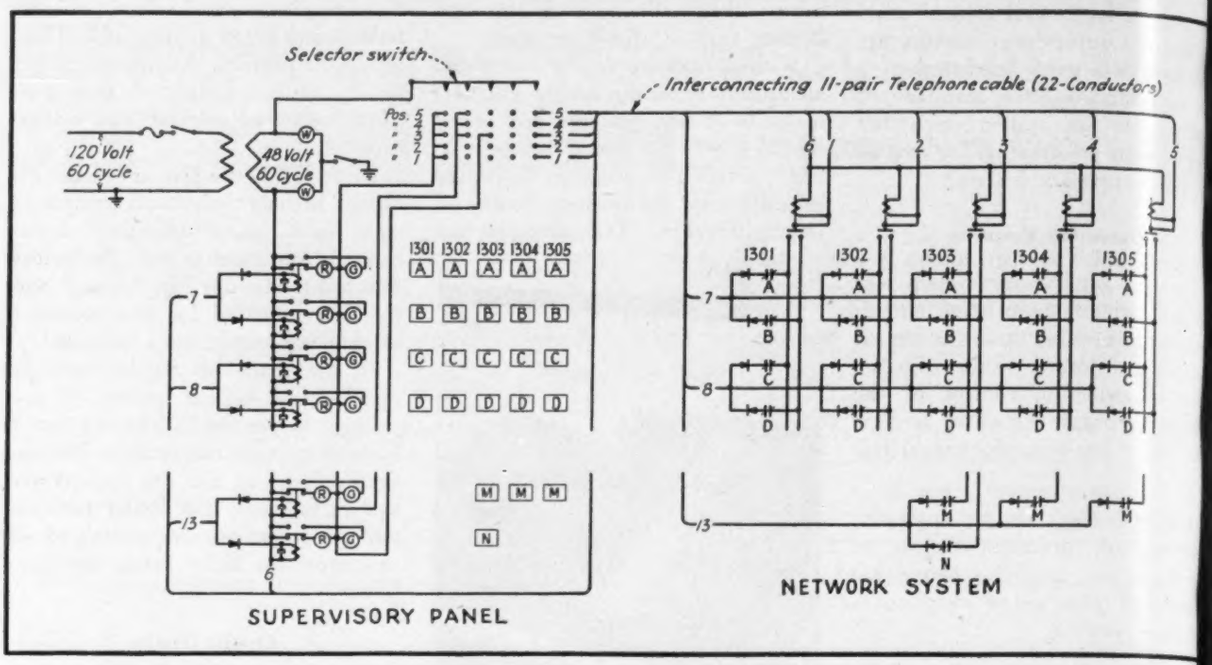
Circuit Design

For simplicity in visualizing the electrical connections of the super-visory system they have been dia-grammed step by step in the accom-panying illustration.

The circuit that is basic to the supervisory system is shown in cir-cuit I. Here an auxiliary switch "b" in each network protector operates a telephone relay equipped with double-throw contacts which energize red and green indicating lights. The auxiliary switch "b" opens when the protector closes and closes when the protector opens. Thus, the red lamp glows when the "b" switch is open, indicating that the network protector is closed; the green lamp glows only when the "b" switch is closed, indi-cating that the network protector is open.

This circuiting may be extended using a common wire to all "b" switches and a separate return to a relay for each "b" switch, as in cir-cuit II. Indication from "b" switch operation is the same as for circuit I. The expansion of this circuiting to provide indications from 64 network protectors would require more con-ductors than were available in the existing eleven-pair telephone cable.

To reduce the number of cable conductors required oxide-film recti-fiers could be used as current blocks in the manner shown in circuit III. Arrows represent direction of current flow permitted by the rectifiers. With "b" switch No. 1 open the rectifier at



WIRING DIAGRAM for supervisory system

"b" switch No. 2 permits only half-wave alternating current to flow in the circuit. This half-wave current is permitted to pass by the rectifier at relay No. 2, but the rectifier at relay No. 1 blocks it from relay No. 1. Therefore, relay No. 1 is de-energized and the red lamp glows. Relay No. 2 is energized by the half-wave current and the green lamp glows. Opening switch No. 2 de-energizes both relays. Closing "b" switch No. 1 energizes only relay No. 1.

Problems Overcome

Thus, circuit III duplicates circuit II in performance using only two wires instead of the three required for circuit III. Extending the scheme still further, circuit IV can be set up. Thus, two relays operate indicating lights to show the position of ten "b" switches by the use of a selector switch.

Six conductors are required between the network system and the control panel to operate ten switches. However, by adding two relays and another group of ten switches independent indication can be obtained on twenty switches with seven wires. Thirty switches can be supervised with eight cable conductors, forty with nine, fifty with ten, and so on. This scheme was the one used in connecting the 64 network protector auxiliary switches to the indicating board as shown in the complete wiring diagram.

D.c. relays were used and coils shunted with small capacitors to prevent contact chattering. On half-wave a.c. the coil is not fully energized half the time, and the capacitor discharge through the coil during the opposite half-cycle gives smoother relay operation and permits finer adjustment.

Selenium-oxide rectifiers were used. No oxide-film rectifier is a perfect current block. There is always some flow of half-wave current against the rectifier. To obtain reliable relay operation excessive paralleling of rectifiers in the block direction must be avoided. Since normally all network protectors are closed except those on the feeder being tested or checked, the choice of "b" switches (which are open when the protectors are closed) was made and parallel rectifier circuits thereby reduced.

In the complete wiring diagram it will be noticed that two common control wires are used for each feeder within the network system itself, and that they are isolated from each other except when that particular feeder is being checked. This is to avoid "sneak" or bypass circuits, which would cause false indications whenever two feeders were de-energized or when one feeder and certain transformer banks on other feeders were de-energized.

A 48-volt supply circuit was used because a lower voltage would invite switch contact trouble and a higher voltage would impose unnecessary strain on the telephone cable insulation.

Economic and Operating Experience

Excluding the existing telephone cable, the supervisory system was installed at a total cost of slightly more than $4,000, the major part of which was installation labor.

Records show that in the first year of the system's operation there was a considerable reduction in the total costs of operation and maintenance of the underground network system. Analysis of these records indicates that more than $750 of this reduction is directly attributable to the use of the supervisory system. This shows an annual return of approximately 18 percent on the original investment. In terms of man-hours reduction, which is now particularly important, the first year's operation saved about 650 man-hours. As the network system grows both investment return and man-hour savings should increase.

The system has been in use for a year and a half and its operation has been completely reliable. Maintenance of the supervisory system has been negligible.

Job Break-down Under Group Study Plan

Turbo-generator overhaul meticulously planned by whole working group on blackboard and on paper, consequently a 56-day task was cleaned up in 19 days, with lost-time generation charge cut two-thirds

. A. WOODHEAD, In Charge of Plant Construction and Operation, Idaho Power Company

DAHO POWER CO. has inaugu-ated a job breakdown plan as an ap-roach to all job problems. So far e plan is being used only in the ant department, but it might easily applied to any job problem. It is mittedly new and it is expected that finement will come with added ex-rience.

The plan was devised to give the roup involved all of the knowledge ithin the group, through group dis-ussion, of each job problem before e job starts. It has resulted in reatly reduced outage time of the achine or piece of equipment in-olved, places men of the proper atti-ades where they belong and brings the attention of all the hazards hich can be anticipated from past xperience, and this by making known the entire group for their informa-on all the trade knowledge so neces-ary to proper control of any job.

All Participate

In brief, the group plan of han-ling a job is as follows: Job super-ntendents, foremen and all men who ill work on the job in any capacity re first brought together at a meet-g or series of meetings, depending n the size of the job. The job fore-an takes charge and he has a large lackboard on which the job problem first set down in a few words. Then ey break the job down into its gical parts, writing each down on e board under six main heads: Job equirements; Job Unit Operations; rotection of Men and Equipment; ontrol Points; Known Facts, and rew Requirements.

As the discussion proceeds, the ma-hine or other piece of equipment is figuratively torn apart beforehand, the part or parts to be repaired are described and the repair procedure settled upon. All tools that will be required for each step are listed so that they can be ready when work begins. The same goes for materials. Every man has his work assigned to him, and the time is estimated as accurately as possible.

Each man's job is discussed in the presence of all, so that not only does each man know what he is to do but all other men as well are familiar with his part in the job as well as their own. In the discussions, all in the group take part, making suggestions as to the best way to handle each element of the job. The procedure decided upon for each step is set down on the blackboard, and later copied on a form provided for the purpose.

Job Done "On Paper"

Thus the group actually does the job on paper. Each one visualizes it as a whole and each knows what he is to do and how his work fits in with that of the others. If the job is quite complicated (a machine, for instance), a cross-section may be made up (see accompanying illustration) and a number of photostatic copies made, and for each major step of dismantling, the part taken away is then blocked out from one of the copies. Some men say that it is difficult for them to visualize the work as a whole. This method of "shrinking" the drawing step by step is a great help to them.

Results of this group breakdown method are said to be astonishing. It may take a number of man-days in time (it is all done on company time), but that time is made up many times over when the work gets under way. Under the old procedure, by starting in on a job without preparation, men stand around losing time arguing over how a certain thing is to be done, lose time going after tools and materials that were not thought of until they are necessary. Others can't work because the foreman is busy on some other phase giving instructions to some one else, etc. Everybody knows the time lost under the ordinary unplanned approach. It is like a boss carpenter starting out with a crew to build a house without blueprints available for any one to see. The boss may have in his head a pretty clear idea

Interpretation of Job Breakdown Table

***Remarks*—Known facts related to total job problem. Additional remarks on reverse side.**

***Job Unit*—Preferably, but not necessarily, in order of performance.**

***Job Unit Operations*—Sequence of physical performance within job unit. Any logical segment of the work the performance of which advances the work.**

***Protection to Men and Equipment*—List all accident prevention measures opposite to Job Unit Operations. Underscore important accident prevention measures.**

***Control Points*—Skills or conditions, which, if neglected, would cause the job to suffer. Anything in the Job Unit Operation that might make or break the job.**

***Known Facts*—Related to Job Unit Operation that must be considered if work progresses with confidence as to final outcome.**

***Crew Requirements*—Shifts, Men. Days.**

TABLE I

IDAHO POWER COMPANY—JOB BREAKDOWN

JOB Overhaul Complete Hydro-Turbine Unit PLANT DATE April 30, 1943. PAGE

REMARKS: (Known Job Facts) Capacity 6,000 Kv. Loss each 24 Hours 144,000 Kw.-hr. Loss in return at $.003 equals $432.00 each day.

Stator winding damaged. Shaft not plumb within .139". Stator must be realigned to rotor, rebored, and reanchored. All bearings to be inspected and repaired. Turbine runner to be metallized. Speed ring vanes to be repaired where broken.

	JOB UNITS	JOB UNIT OPERATIONS	PROTECTION TO MEN AND EQUIPMENT	CONTROL POINTS	KNOWN FACTS	CREW REQUIREMENTS S	W	2
	Preliminary	Check and determine if water has been removed, gates locked, and switches tagged.	Extra instruction in safety must be given. Be sure that all precaution against accidental opening of head gates and closing of switches has been taken.	Conditions suggest the need for close and constant supervision and unbroken attention by every one to avoid accident to men and equipment or delays to the work.	A critically needed generating unit is out of service. Inexperienced help will be employed.	2	5	1
	Dismantle down to and including rotor.	Uncover generator by removing hood.	Check head gates and switches against accidental operation. Operation of crane must be assigned to capable operator. The giving of signals must be assigned to an alert and experienced workman. Designate signals and be certain all signals are fully understood.	Experienced crane and signal men are essential.				
●		Inspect crane, electrically and mechanically; lubricate.	Choose tools carefully. Use socket wrenches. Be concerned about workmen's ability to use wrenches safely.	Adequate containers should be provided for small parts. Parts should be match marked.	Precautions have been taken against accidental opening of gates and operation of switches.			
		Assign dependable member of crew to keep tools and parts in proper order.	A workman to keep previous clean and small tools in place is highly worth while. Keep all oil and dirt from under foot. Be alert for good housekeeping.	Location for storage should be determined. Crane man receives signals from signal man only.	Hood weighs about 1½ tons.			
		Select rigging and prepare steel cable slings.	One 3/4" plow steel cable, with loop at each end and long enough to place each loop on crane hook for two parts with 3/4" crew shackle at lower end, is recommended.	Position signal man so signals are received clearly. Use safety factor of six on cable.				
		Spot crane over center of load. Install sling.	Use two 3/4" Crosby clamps at each loop with U of clamp on loose end. Do not use bad cable. Look out for kinks and ragged wire ends and leave no loose ends.	Unnecessary delay and confusion will result by not providing adequate containers for small parts.				
			Protect hands always. Ragged wire ends are dangerous. Inspect lifting eye. Look for cracks in steel plate near eye. Make sure of footing. Be particularly alert when on sloping steel surface. Be fully concerned about the danger of metal shod shoes. Shoes with leather soles and rubber heels are recommended. Check for free movement.					
●		Match mark parts.						
		Unbolt hood. Remove all bolts and install temporarily two safety bolts sufficiently long to permit hood to lift approximately six inches. Take slight strain.	Crane man must receive signals from signal man only. Be sure that all bolts were removed. Be sure that load is not on side struts.					
		Install tag line on edge of hood. Select suitable place for storing hood. Remove hood to storage	Reposition crane hook if not directly over center. Be sure of clearance. Keep out from under load. Do not ride load. Go slow.					
		Remove end bells and fire line. Remove plates from rotor arms.	Look out for sharp edges.	Avoid mismatching parts and match mark parts before removing.	Plates weigh 100 lbs. each.			
●		Install platform on lower flange of rotor arms. Clean all surfaces of oil, dirt and grease. Prepare adequate stairs or ladder	Adequate containers for small parts are necessary. Avoid dropping small parts. Recover immediately any small part or tool that falls.	Use 2" plank cut to fit.				
		Prepare storage space in the clear of all other work for plates, bells, and pipe. Remove inner steel band from bells.	Guard against accident to men below. Exercise great care in handling bells. Guard against injury to hands and feet. Consider danger in connection with the use of	Parts must be match marked. Keep control by storing bells in order of assembly.	End bells are bulky. Two or more men required to handle.			
		Unbolt and remove in order, all bolts not used to support fire line.	hobnailed shoes. Guard against injury to stator winding. Two men on machine pass bolts to one man on roof. Be sure to make use of containers for small parts. Choose proper position for lifting.		Working conditions more or less hazardous. Fire line is supported on certain bolts that cannot be taken out until fire line is unbolted and blocked.			
		Unbolt fire line and block free of stator coils.	Provide safe tools. Make certain of safe footing. Bolts must not be dropped because they are made of thin cast iron. Protect stator coils.		Bolts weigh around 50 lbs. each. Bolts are made of thin cast iron. There are 48 bolts.			
		Remove balance of end bells. Separate fire line into three parts; remove and store.	Use at least three men for this operation. Leather gloves are recommended. Guard against slipping wrenches. Use great care against dropping tools on machine parts.	All bolts and nuts should be put together, nuts on bolt, in containers provided for this purpose.	Fire line consists of 2" pipe. Each section of fire line weighs approximately 100 lbs.			
●			Don't drop small parts into generator. Recover immediately any part that has been dropped. Don't lay parts or tools around loose to be accidentally pushed or kicked off, injuring men or machinery below.	All doubtful matching should be marked.	Fire line is attached to every other bolt with U bolts.			
		Remove rotor. Measure and record air gap. Clean all surfaces of oil and dirt.	Place crane directly over center using plumb bob. Do not use inflammable cleaning fluid.	Locate storage properly in the clear with adequate blocks. Keep control of assembly by checking match markings.	Rotor now rests on step block. Weight of complete rotor is approximately 65 tons. Total weight of rotating part is around 115 tons.			
		Prepare and install sling.	Protect eyes. Look out for ragged ends on cable. Leather gloves are recommended.	Be concerned about total weight of rotating part in installing sling.	Stator to rotor clearance is around .125" average. Air gap is uneven.			
			One inch good condition plow steel cable is recommended. Thirteen parts are required for safety. Four parts on each arm. Sling angle should not exceed 1-horizontal, 1-vertical.	In this case it is recommended that a factor of safety of at least four on a total load of 115 tons is advised.	There are four legs on rotor.			
●								

TABLE II

IDAHO POWER COMPANY—JOB BREAKDOWN

JOB _____ PLANT _____ DATE _____ PAGE _____

REMARKS:

JOB UNITS	JOB UNIT OPERATIONS	PROTECTION TO MEN AND EQUIPMENT	CONTROL POINTS	KNOWN FACTS	CREW REQUIREMENTS S	M	D
Dismantle down to and including rotor. (Cont.)			Rotor may 'stick' on step block and greater strain than weight of rotor may be known.	Crane clearance over stator is around 90'.			
		Use two pieces of cable, each long enough for eight parts. Avoid crossing cable on hook. Eliminate ragged ends. Use socket wrenches on Crosby clamps.	Safety factor of six on rotor weight is recommended. Use 6 Crosby clamps, 3 facing each way with 2" eyes loose and 6" apart. Clamps must not be tightened more than necessary at this time.	Shaft is 18" in diameter and approximately 24' long. There are 60 pole pieces.			
		Avoid kinks in cable. Stay away from sling while under load.					
	Remove clamp bolts from rotor hub.	Solid open-end wrench with 6' piece extra strong 2" pipe; using 16 lb. hammer and rope blocks. Keep from under pipe. Don't let wrench slip. Provide protection for man holding wrench.	Match marks between nuts and bolts should be checked. These are close quarters. More than the average amount of hazard exists.	Bolts weigh approximately 100 lb. each. There are six such bolts 3½" diameter, about 40" long.			
		Look out for a glancing hammer. Provide safe footing. Consider danger of bobtailed shoes on iron. Keep surfaces under foot dry and clean. Man holding wrench should protect eyes against flying pieces of iron.					
	Loosen rotor hub connection to step block. Measure clearance between hub and step block. Take strain, about 10%	Be sure to use wedges with slim taper. Steep tapered wedges are dangerous. Stand in the clear and apply wedges uniformly throughout depth of hub.	A separation of from .015" to .025" is considered adequate. Use long thickness gauges for this. Check clearance between rotor hub and step block to separation for free movement.	Steep tapered wedges will jump out.			
		Check crane for center over rotor.					
	Adjust load between strands. Tighten clamps to about 90# Take about 25% load. Make further adjustment between strands. Tighten cable clamps.	Be sure to keep hook on center. "Fan" cable to adjust load between strands. Use great care in "fanning" cable. Use socket wrenches.					
	Prepare storage space with block to clear fan blades. Match mark lead driving key and make it secure against falling	Be sure blocks are dry. Be sure top of blocks are level. Lift load slowly.	Key should be left in place until rotor is lifted off.	Wet blocks will corrode braking surface. Key might fall when rotor leaves hub.			
	Lift rotor to within one inch of leaving top of step block. Check tendency to swing.	Use tag line. Watch ends of cable. Be sure to stop to within one inch of coming off. Check tendency to swing.	Rotor must not be lifted completely off until placed exactly on center. Rotor will swing and it may damage winding if not on exact center.	Rotor might swing when it leaves step block if not on exact center.			
		Correct to center position as is necessary. Crane hook must be over center of load.	Feeler gauge is good for the purpose of checking for center.				
	Place rotor on storage blocks. Provide weather protection and heat.	Keep out from under. Don't ride load. Look out for sharp slivers. Avoid condensation on rotor parts while in storage.	Order in reassembling may be lost if too much 'tiring out' has to be done. Correlating job units successfully calls for no delays in any job operation.	Winding will absorb moisture in changing temperatures.			
	Uncheck from load and tie slings in position and leave intact.	Is night lighting adequate?					
Repair stator.	Install platform. Check stator insulation to ground and between phases.	Be sure platform is sufficiently tight for protection of men below. Be concerned about assembling proper tools.	Check supply of new coils, insulation and wedges on hand. Weather protection and heat may be necessary. Be sure to determine condition of spare parts without loss of time.	The successful outcome of the entire operation depends upon success here. You will be sure to go slow and you will be certain of the correct and satisfactory completion of each operation in its proper relation to all other parts of the winding operations.	2	3	17
	Separate damaged winding from undamaged section. Check insulation again. Provide weather protection if necessary. Place materials on hand for rewinding work.	Be certain all damaged winding has been disconnected electrically from good winding. Be sure to record insulation resistance for each section checked.					
	Make record of coil grouping. Remove end connections. Check insulation to ground and between phases on good section as work progresses.	Protect insulation against further damage. Conserve jumpers for further use.	Saving of time will result from ready information of grouping being available when reconnecting coils. This information on insulation resistance will determine when all damaged winding has been isolated.				
	Remove bad coils and conserve.	In removing avoid bending.	Control of the winding job may be lost if old coils are not preserved as removed. They may have to be reused later.				
		Apply pressure uniformly. Provide approved pullers for this work. Protect hands against sharp edges and corners.					
	Tie old coils, not completely removed, outwardly so as to admit new coils freely.	In removing wedges, avoid damage to wedges and insulation. These tools should not have cutting edges. Use coil jacks designed to apply pressure uniformly over total length of coil.	Old coils, not completely removed, are tied to prevent unnecessary breakage of insulation while inserting new coils.				
	Clean abrasions from iron laminations. Prepare and install guides to hold new coils in proper vertical relation. Install new coils and insulation.	Look out for hand cuts. Be sure to protect the eyes. These are close quarters; be alert. Be certain ladders will not slip. Guard against accident to men below. Keep floor and platforms clean. Avoid damage to coils. Do not hand.	Old coils may be repaired for future use. Do as little damage as possible while removing them. Uniform application of pressure will stop warping of coils and consequent damage to insulation.	Sharp edges at the iron surfaces will cut thru slot insulation. Insulation materials dropped or laid on dirty platform may no longer be safe for use. Small turn buckle jack against shaft straight bar applied against full length of coil has proven good.			
	Install wedges	Avoid unnecessary damage to insulation later while in service by being certain slots are all full and wedges tight.	If coils are tight, place slot insulation at bottom and use insulation lubricant. Be certain slots are full.	Paraffin is a good lubricant for coils. Coils will move under load and damage the insulation.			
	Check phase and ground resistance.	Be certain all new coils are properly insulated before grouping.	To install series and parallel jumpers and find bad coil insulation later would destroy completely the correlated relation between the designed conclusion of various job units.	New coils have often been damaged beyond use by not making insulation tests as the job progresses.			
	Install temporary jumpers for coil grouping tests.						

TABLE III — IDAHO POWER COMPANY—JOB BREAKDOWN

JOB _____ PLANT _____ DATE _____ PAGE _____

REMARKS:

	JOB UNITS	JOB UNIT OPERATIONS	PROTECTION TO MEN AND EQUIPMENT	CONTROL POINTS	KNOWN FACTS	CREW REQUIREMENTS
	Reposition stator for uniform air gap.	Remove stator hold-down bolts. Check center relation with shaft. Remove dowels. Move stator to obtain center relation with shaft. Check with tram points opposite jack bolts.	Consider the need of pads for protection of men working in close quarters on cold iron and concrete. Injury to knees, elbows, head, face, hands, and eyes could easily occur here. Go very slowly in these close quarters. Clean thoroughly with vacuum cleaner before starting work on this unit. Guard against damage to threaded holes.	Tram points and micrometers are found to be a good method for checking center relation. Uniform pressure at jack bolts will avoid warping stator frame. Measurements at 45° points will be found useful in minimizing time.	It is known there are insufficient dowels on the stator. Present dowels are radial type. Additional dowels, vertical straight type, are to be used. At least six of each kind will be installed. Additional anchor bolts will be necessary.	2 4 7
			Provide ventilation, warm or cold air, as the occasion demands. Avoid blowing metal chips in stator.	Guide bearing clearances should be taken into consideration in computing this relation.	At least six more 1" will be required. More clearance will be necessary around jack bolt blocks.	
●		Ream hold-down bolt holes. Install hold-down bolts.		The use of drills, reamers, grinders, pneumatic chipping hammer and air driven drills are recommended.		
		Drill for new anchor bolts on center between old bolts. Check guide bearing clearances.	Be sure chips and drillings do not enter armature winding.	Vacuum cleaners and magnets are handy for cleaning new holes and removing drilling and chips.	Guide bearing could be off center and have bad effect on center relation of stator and shaft if not taken into consideration.	
		Recheck and record clearances at turbine runner. Recheck plumb alignment at shaft and record. Make corrections.				
		Recheck and record center relation between stator and shaft. Make minor adjustments as necessary. Drill for dowels.	Clean away all drilling and chips. Be sure to protect eyes, face, and head.	The use of vacuum cleaners and magnets are effective.		
		Install dowels and tighten all anchor bolts.	Go slow and be certain of proper protection to men. Be mindful of men working below. Don't drop anything. Remove all loose parts for air ducts and armature.	In keeping chips and drillings from internal parts of generator.	Tightening may have warped armature from true circle.	
●		Check again for uniformity in air gap.	Clean thoroughly to avoid loose parts being left in generator.	It is important to permit armature to take natural shape and then correct to true circle.		
	Reinstall rotor, end bells, and hood, and put away tool steadings and materials not used. (cont.)	Remove all tools and check again for loose material in generator. Connect field circuit.	Look out for bad insulation. Insulation resistance at field winding should be recorded.			
		Check and record clearances at air gap.	Be sure contact surfaces are all clean and keep insulation clean and free from moisture. Be certain no loose parts are in air gap space. End bells are this cast iron and break easily.	Should small bolts be twisted off, broken parts could fall into the machine and be difficult to recover.	A record of air gap at 45° points is desirable. Fire line is attached to end bells with U bolts and must be placed in position before any end bells are bolted on.	
			Don't drop. Care must be exercised that small bolts are not twisted off. Should loose parts fall into the generator, they must be recovered immediately.	In assembling a unit of this kind, it is extremely important to have a record of all bolts and parts as well as small tools. And when this particular unit of the job is complete, all parts should be accounted for. This is to insure none of them being left in the machine.		
			Socket wrenches are advisable to avoid injury to hands. Be certain bolts and cap screws are not subjected to side strains.		Bolts and screws put on side strains will be subjected to early fatigue.	
●			Examine all bolts and screws to be certain none are left loose.		One small bolt or nut falling into the rotor or field of the generator while in operation will do serious damage.	
		Install steel band at inner circle of bells.	Care must be exercised while attaching band to bell. Small bolts and cap screws can easily be twisted off if too tight and they may fall out while the machine is in operation if left loose.	It is not considered good practice to use old bolts and screws if threads are damaged in any way or if the bolts are reduced in section at any point.	An old bolt will not reveal to what extent it is fatigued until it breaks. One broken 5 cent bolt can wreck a $200,000 unit.	
			Examine generator again for loose parts. Don't have loose metal in pockets while crawling through air ducts on rotor.	It is a good idea to look for age in a bolt or any tension rod and if any great amount is revealed in any way, junk it.	Loose metal left in the generator will most certainly do serious damage later.	
		Install hood cover (bonnet)	Be certain everything is in the clear. Be certain that nothing has been left in the generator.		This is the last opportunity to be sure that nothing loose has been left under the hood.	
		In accordance with breakdown estimates the summary is as follows:				
		All work is on a two shift basis.				
		Preliminary preparation — 1 day — 5 men				
●		Crew No. 1 — Repair Stator — 17 days — 3 men				On this basis we have allocated 530 man days to the total job problem. But since all units will close out simultaneously and certain units require less over all time than others, there will be a surplus of labor in the amount of 104 man days for work not anticipated in the regular assignments.
		Crew No. 2 — Repair Turbine — 14 days — 4 men — which leaves 5 men 1 days for flexible uses.				
		Crew No. 3 — (Realign Shaft — 6 days) (Reposition Stator — 7 days) — 4 men — which leaves 4 men 4 days for flexible uses.				
		Crew No. 4 — (Inspect, Repair Upper Guide — 2 days) (Inspect, Repair Lower Guide — 6 days) (Inspect, Repair Kingsbury — 2 days) — 3 men — which leaves 3 men 7 days for flexible uses.				
		Closing Operation — 1 day — 5 men				
		Total outage time for the generating unit is 19 days. Largest unit is 17 days plus 1 day each for preliminary and closing operations. Total crew requirements is 30 men. All operations can be confined within the 17 days required for the largest unit without overlapping. Thus what otherwise could have been a 56 day outage of a major unit and a 560 man-day job has been reduced to a 19 day outage and 530 man-day job, and loss in power generated is reduced from around 12 million kwh to 2-3/4 million kwh. Seasonal labor and material balance out uniformly. The loss in return by virtue of the outage, on the basis of .005 mills, has been reduced from $24,000 to $2,650.				
●						

of what he is going to build, but to tell it all over and over again to each workman at each step would take a lot of time.

Take an example: Not long ago we had a 6,000-kw. unit that was forced out of service because of failure in the winding and from misalignments as a result of concrete shifting.

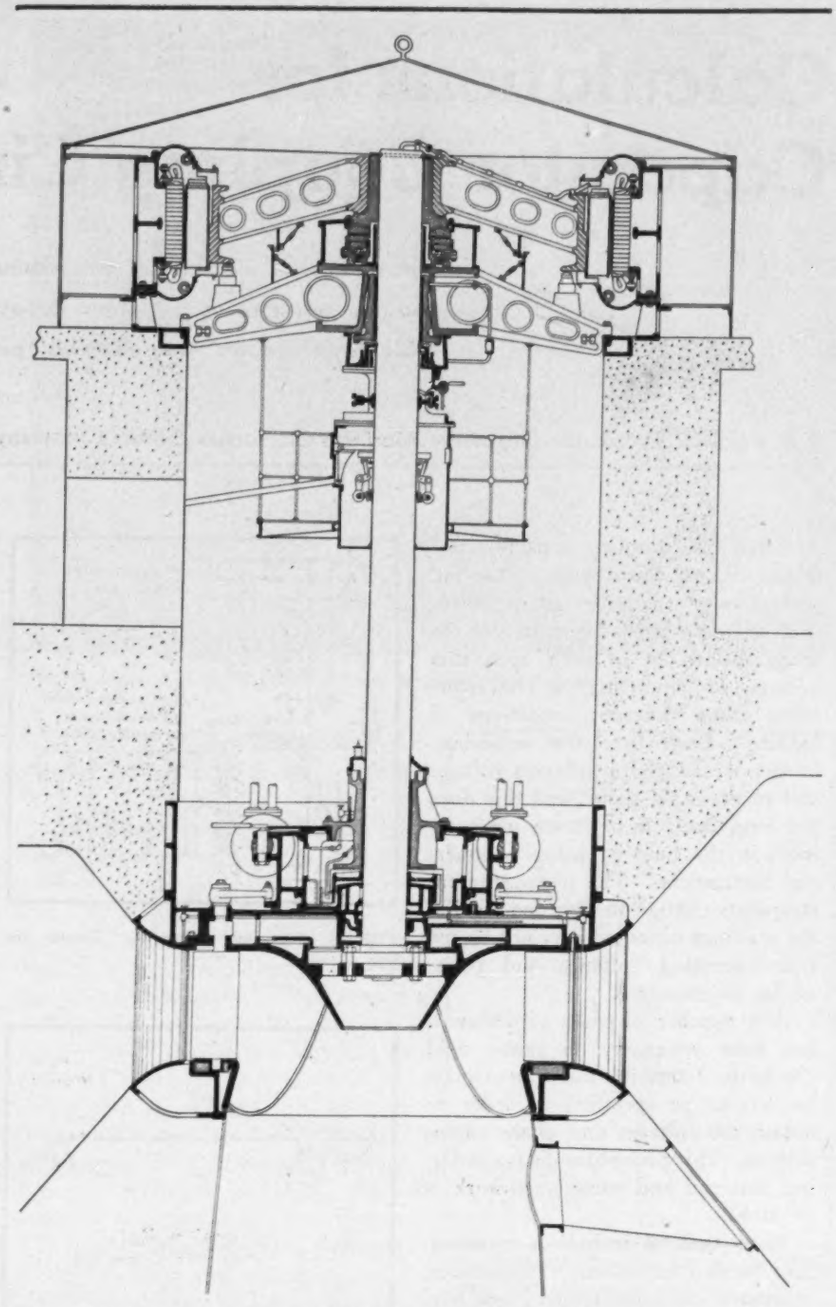
Ordinarily, following the lines of least resistance, this would have been a 56-day outage as near as could be estimated without preliminary study, and I am sure that is just about what it would have turned out to be. Group participation on the problem brought out the fact that the job could be broken down into six job units. The largest unit would involve a maximum of 17 days. Allowing one day for preliminaries and one day for closing up brought it up to 19 days. There was nothing in the total job that would involve overlapping of work, therefore the total time for the work would be that of the largest unit, or 19 days, which is a lot different than 56 days."

The job just mentioned required the filling in of 17 sheets of the blank form, of which only samples from about six and the last are here reproduced. It took several meetings of the group to complete the study. This looks like a lot of time spent. But contrast the 19-day job with the 56-day one and it is not hard to see that the time was well spent.

Superintendent Presides

Taking the lead in all this is the job superintendent. He presides at the discussion, but all are encouraged to participate. Each one knows what it is all about and the work sheets are in reality like blueprints of the job and can be consulted by everybody as the job goes on. So it is an easy job to superintend, it moves smoothly and quickly and there are no jams.

Systematic breadown of a major job into several minor jobs has another advantage. Many of these minor jobs are of a nature that may come up again in the future. In that case the planning, except for minor changes, is already done. The job superintendent has his record sheets to refer to at any time. In cases where the work is of such a nature that it may come up again in other plants the supervisor of construction and operation takes the job superintendent's job sheets, which are usually penciled, and has them typed and several copies made, to be filed in his office ready for use in another part of the system.



SECTION of 6,000-kw. unit on which the job was reduced from a previously estimated 56-day outage to 19 days; several photostatic copies were made of this drawing and as the study progressed in the group meetings the work already disposed of was blocked out on the drawings; men claimed this made it easier for them to visualize the work in advance

The breakdown system is especially valuable under present conditions when work must be done in haste, often using tools and materials that would not be used under normal conditions. There is where many heads are better than one in devising ways and means to prosecute the work. Furthermore, by planning ahead the work can be accomplished at less hazard to men and equipment. The "breakdown" affords an excellent opportunity to translate into specific terms for each job the safety precepts which have matured over the years, but have become too generalized in phraseology to render them more broadly significant.

Calculations for Capacitor Coupling Circuits

Knowledge of methods of calculating voltages and phase angles with various burdens on coupling capacitor potential devices makes possible their greater use — Typical problem is calculated step by step

J. H. VIVIAN, Protection Engineer, Southern California Edison Company, Ltd., Los Angeles

ALTHOUGH coupling capacitor potential devices have been in use for several years, many design engineers and testmen have been unable to make fullest use of such apparatus because of the invariable characteristics under different conditions of loading. Each time the secondary burden is changed a different voltage and phase angle occur, and this does not lend itself to accurate measurement in the field by using commercial instruments. The measuring instruments change the burden so that the readings obtained may not be the true operating voltages and phase angles as measured.

In a number of cases of design it has been necessary to make field checks to determine the approximate burden to be specified in order to obtain the voltages and phase angles desired. This procedure delays ordering material and some guesswork is required.

Many designs include a combination burden consisting of resistance, reactance and capacitance. These burdens are connected to the secondary network of the capacitor device to obtain the correct voltages and phase angles. Occasionally these circuits have become oscillatory and temporary disturbances have resulted.

Usually the burdens furnished by the manufacturer must include more reactors and capacitors than actually required. This is necessary to insure sufficient adjustment of voltages and phase angles required for commercial applications. Many specific installations can be designed to use resistance loading only, except for the usual instrument burdens.

Harmonic voltages which may cause oscillations are thus eliminated.

With a little effort such circuits may be calculated and all guesswork removed. The capacitor potential device then lends itself to many uses that result in better system operation. For example, all lines or buses having these devices may have voltage indication, synchronizing facilities, carrier current coupling and potential for relaying purposes if desired. The use of a transfer switch having substitute burdens will permit any or all of the regular secondary burdens to be switched on or off without changing the phase angle or voltage. Substitute burdens usually consist of resistance only.

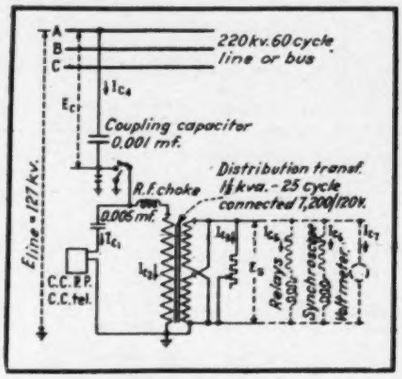


FIG. 1—Coupling capacitor circuit for 220 kv.

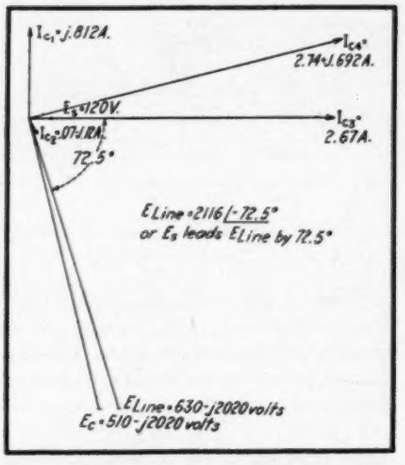

I c1 = j.812A.
I c4 = 2.74 - j.692A.
E s = 120 V.
I c2 = .07 - j1.82A.
72.5°
I c3 = 2.67A.
E Line = 2116 /-72.5°
or Es leads E Line by 72.5°
E Line = 630 - j2020 volts
Ec = 510 - j2020 volts

FIG. 2—Vector diagram of coupling capacitor and secondary resistance burden

The method of calculation is explained by using a fundamental circuit as shown in Fig. 1. Coupling capacitor is 0.001 mf., connected 127,000 volts to ground. The auxiliary capacitor for carrier current coupling is 0.005 mf. It should be noted that it is safer practice to add this capacitor whether or not carrier current coupling is being used. The transformer is a 1½ kva., 25-cycle distribution type, 7,200 / 240 / 120 volts, connected in this example for 7,200/120 volts. The transformer may also be connected 7,200/240 volts for other desired phase angles. A 25-cycle transformer is used in order to lessen the third harmonic exciting current.

Example: I_{c_1} = Current in auxiliary capacitor.
I_{c_2} = Magnetizing current of transformer.
I_{c_3} = Adjustable resistor burden.
$I_{c_4} = (\bar{I}_{c_1} + \bar{I}_{c_2} + \bar{I}_{c_3})$ = Current in large capacitor.
E_s = Secondary reference voltage of 120 volts at 0 deg.
E_c = Voltage across large capacitor = $(\bar{E}_{\text{Line}} - \bar{E}_s)$
E_{Line} = 127,000 volts to ground.

All currents and voltages are vectorial quantities and are to be referred to the low-voltage side of the transformer.

Step 1 — Obtain transformer data.
1½ kva., 7,200/120 volts = 60/1.
Exciting current at 120 volts = 140 M.A.
$120 \times 0.14 = 16.8$ = volt-amperes.
Core loss = 8.5 watts.

$$Z = \frac{V^2}{V.A.} = \frac{14{,}400}{16.8} = 858 \text{ ohms.}$$

$$R = \frac{W}{V.A.} \times Z = \frac{8.5}{16.8} \times 858 = 433 \text{ ohms.}$$

$X = \sqrt{858^2 - 433^2} = 745$ ohms.
$R + jX = 433 + j745$ for transformer impedance.

Transformer series impedance is so small that it is neglected.

Step 2 — Find impedance of branch circuits and refer all to secondary side.
0.001 mf. at 60 cycles = 2,650,000 ohms.
Referred to secondary side by dividing primary ohms by the transformer ratio squared.

$$\frac{2{,}650{,}000}{3{,}600} = 737 \text{ ohms} = -j737$$

0.005 mf. at 60 cycles = 532,000 ohms.

$$\frac{532{,}000}{3{,}600} = 148 \text{ ohms} = -j148$$

127,000 volts referred to secondary side $= \frac{127{,}000}{60} = 2{,}116$ volts $= E_{Line}$

Step 3 — Find currents in all circuits.

$$I_{c1} = \frac{120 \angle 0^\circ}{-j148} = j0.812 \text{ amps.}$$

$$I_{c2} = \frac{120 \angle 0^\circ}{433 + j745} = 0.07 - j0.12 \text{ amps.}$$

$$I_{c3} = \frac{120 \angle 0^\circ}{45} = 2.67 \text{ amp.}$$

$I_{c4} = \bar{I}_{c1} + \bar{I}_{c2} + \bar{I}_{c3} = 2.74 + j0.692$ amps.

Step 4 — Solve for voltage across main capacitor.

$E_c = I_{c4}(-j737)$
$= -j737\ (2.74 + j0.692) = 510 - j2020$ volts.

Step 5 —

$\bar{E}_c + \bar{E}_s = \bar{E}_{Line}$
$E_{Line} = (510 - j2020) + 120 = 630 - j2020$ volts
$= 2116 \angle -72.5^\circ$,
that is, secondary voltage E_s leads primary voltage E_{Line} to ground by 72.5° (See Fig. 2).

Instrument Burdens

Actually, I_{c3} is the unknown that is usually solved for in the equation because the E_{Line} voltage is known. Resistor in the above example should be set at 45 ohms, but should have a rating of 60 ohms, 1,000 watts. The full 60-ohm I^2R rating should be allowed and a safe heating factor of two given to assure heat dissipation.

When relay potential coils, synchroscopes, voltmeters, etc., are added as burdens, currents I_{c5}, I_{c6}, I_{c7}, etc., may be calculated similar to the method used in calculating I_1, I_2, I_3. Then $\bar{I}_{c1} + \bar{I}_{c2} + \bar{I}_{c3} + \bar{I}_{c5} + \bar{I}_{c6} + \bar{I}_{c7} = I_{c4}$. The smaller burdens can usually be omitted in the calculations.

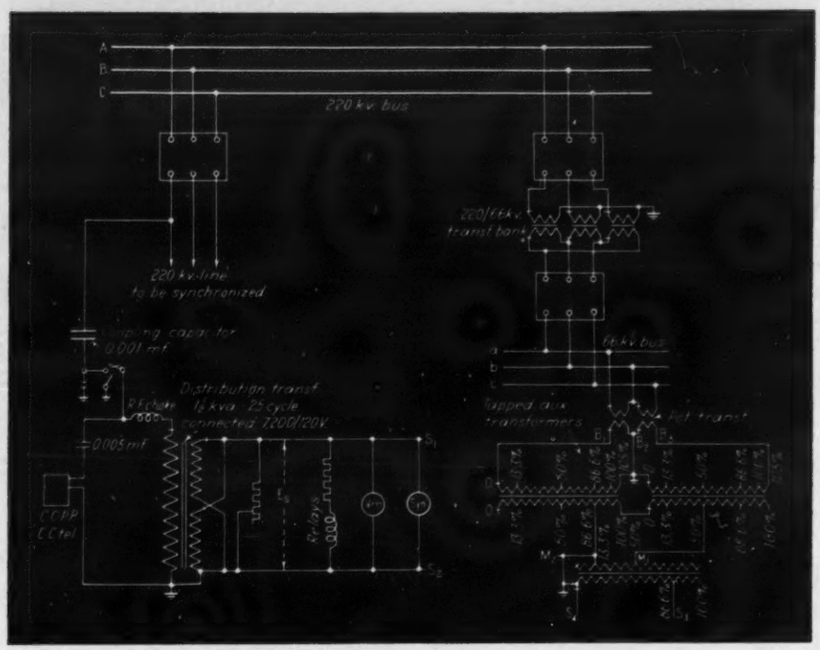


FIG. 3—Method of using potential from coupling capacitor for synchronizing

The circuit given in Fig. 3 will serve as an example to explain the method of using the coupling capacitor as a synchronizing device. Assume E_s to be 120 volts and E_s to lead E_{Line} by 75 deg. after all burdens have been calculated. All secondary voltages to be 120 volts and exact synchronism is desired. From the vector diagram of Fig. 4 it is observed that an angle of 75 deg. exists between the two secondary voltages originating from the primary voltage E_{AO}, namely, B_1B_2 and S_1S_2. These voltages would normally be in phase and used for synchronizing potential.

The 75 deg. difference in phase

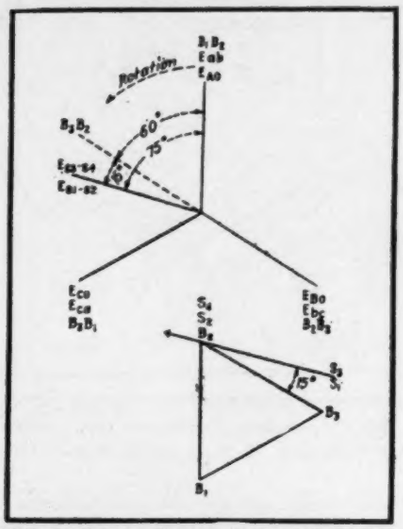


FIG. 4—Vector diagram for synchronizing connections shown in Fig. 3

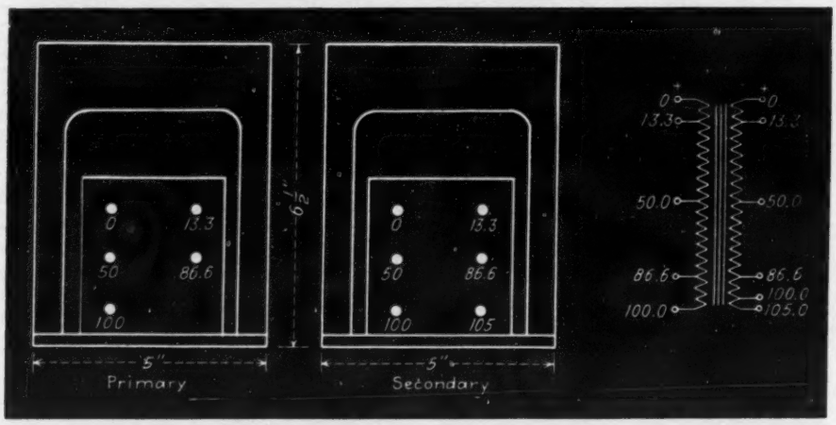


FIG. 5—Tapped auxiliary transformer used in connection with coupling capacitors

angle may be adjusted by several methods, but most methods make use of auxiliary burdens connected to the secondary circuit of the capacitor device. A better method for adjusting the difference in phase angle is to use tapped auxiliary transformers. This method has the big advantage of placing the extra burden on the standard potential transformers. Usually, small resistors are added to the voltmeter circuits to make exact adjustments. Such resistors are used in all methods and are called trimming resistors.

Auxiliary transformers used are shown in Fig. 5. By use of the tap combinations possible, nearly all phase angles can be obtained with

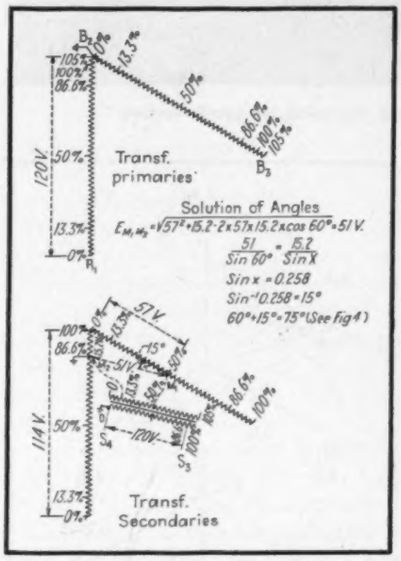


FIG. 6—Auxiliary transformer connections for obtaining 75 deg. phase angle shift

two transformers. A third transformer is often required to obtain correct voltage. The use of two transformers to shift the angle for the 75 deg. connection and one transformer for voltage correction is shown in Fig. 6. Secondary voltages S_1S_2 and S_3S_4 are 120 volts at an angle of 0 deg. after the complete correction has been made.

Approximately 50 installations of capacitor coupling have been applied to the 220-kv. system of the Southern California Edison Company, Ltd., during the past five years. Although many phase angle and voltage combinations have been required, the auxiliary transformer method using resistor loading has proved satisfactory in every installation.

Generator Grounde[r] Resistor i[s]

W. E. MARTER, Duquesne Light Company, and*
A. A. JOHNSON,† Westinghouse Electric & Manufacturing Company

A GENERATOR connected to the delta winding of a step-up power transformer may be grounded through a high resistance to limit line-to-ground fault current to a small value. The generator can be tripped for line-to-ground faults by either a current or voltage relay suitably placed with the neutral resistor. The same type of protection, however, may be obtained more economically and with a more rugged resistor by placing the high-voltage winding of a small distribution transformer (Fig. 1) between the generator neutral and ground with a low-ohm resistor and relaying equipment in the secondary of the distribution transformer. The usual transformer size is about 50 kva. or less and the loss in the resistor is about 50 kw. or less.

Current in the fault consists of two parts, that which goes through the neutral and that which goes through the shunt capacitive branches. The total fault current consists of the vector sum of the capacitive current and the current through the primary winding of the grounding transformer. This total current usually amounts to less than 10 amp., although in special cases it may be somewhat greater. The neutral of the high-voltage winding of the main power transformer may be solidly grounded, or may be grounded through an impedance device.

This article deals specifically with the grounding of generator neutrals; the same scheme also may be used in the neutral of a 3-phase grounding transformer for ground fault indication on any of the three phases.

Installations Made

Installations using this type of generator-neutral-grounding have been made on various power systems in this country; the Duquesne Light Company has three installations on main-station generators and one on a station service unit. Characteristics of these units are given in the accompanying table. The calculated capacity figure includes generator, leads, low side of connected transformer bank, and surge protection.

A variable resistor was utilized on the station service generator, since exact information on the connected equipment was not available. The permanent setting of the resistor was

*Relay Engineer. †Central Station Engineer.

Installations of Generators Grounded Through Transformer and Resistor

Station	Kv.	Mva.	R.p.M.	Calculated Mfd. Capacity	Remarks
Brunot Island	12	23.6	1,800	0.862	High- and low-pressure elements of one unit
	12	23.6	1,800		
Reed	11.6	75	1,800	0.634	Hydrogen cooled
Phillips	12	75	3,600	0.688	Hydrogen cooled
Phillips	2.3	7.5	3,600		Station service

Through Transformer Primary; Secondary

Standard distribution transformer in conjunction with secondary resistor of appropriate kw. loss value limits line-to-ground fault current to small values — High transient voltages prevented

determined by test after the equipment had been installed. During a ground fault this generator remains in service until connected load is transferred. The resistor value was set to give a resistor current equal to capacitive current; the relay operates an alarm but trips no breakers.

Transformer and resistor at Brunot Island are housed (Fig. 2) in a room in the 12-kv. switch house along with potential and current transformers. The neutral of the generator, consisting of 12-kv. Kerite cable, is carried a distance of about 30 ft. through an air duct. The ground equipment consists of a single-phase, type ASL, 50-kva. Westinghouse air-cooled transformer rated 12,000/480 volts having 4.3 percent impedance. Across the secondary of the transformer is connected a cast-iron grid resistor whose temperature will rise about 350 deg. C. in five minutes at 300 amp. In series with the resistor is a 300/5-amp. type R 7.5 current transformer, the secondary of which feeds a 0.5 to 2.5-amp. CO relay. The relay trip circuit operates differential auxiliary relays to clear the generator. The air-cooled transformer was selected in order to eliminate the oil fire hazard.

Calculations

Selection of the equipment will be illustrated by an example. For this purpose a 75,000-kva., 11.5-kv., 1,800 r.p.m. hydrogen-cooled generator will be used. The capacitance involved per phase is given for each part of the circuit that operates at generator voltage. Such values may be obtained from the manufacturer if they are not already available:

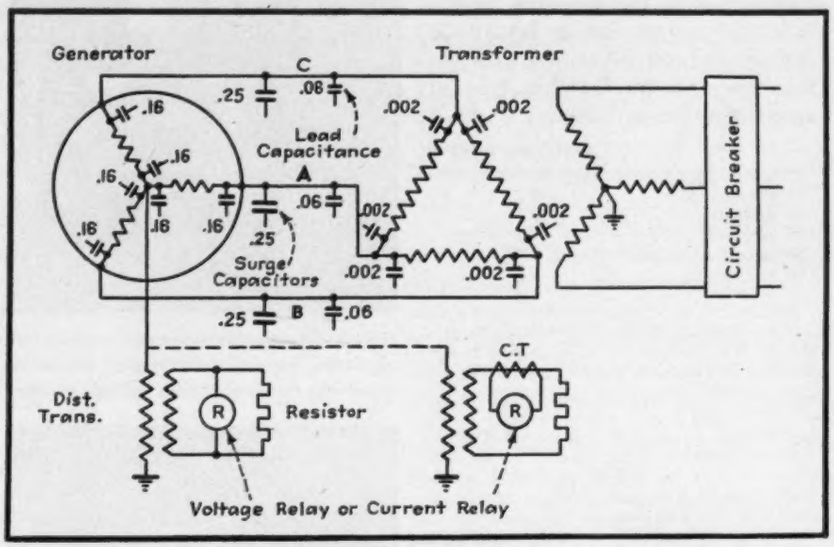


FIG. 1—Capacitance values for generator grounding through distribution transformer fix kw. loss value of secondary resistor

Generator	0.320 mfd.
Generator surge capacitor	0.250 mfd.
Generator leads	0.060 mfd.
Power transformer	0.004 mfd.
Total	0.634 mfd.

For a 60-cycle system this represents a zero sequence reactance of $10^6/377$ (0.634) or 4,180 ohms. Using line-to-ground potential of 6,620 volts, a current of 3(6,620)/4,180 (or 4.75 amp.) will flow through a line-to-ground fault on the generator terminals due to capacitive current alone. Another way to determine this current is to divide the capacitances as shown in Fig. 1, placing half of the capacitance for each phase winding of the generator and transformer on each end of each winding. This means that the capacitances on the ends of the faulted phase windings (0.474 mfd.) are shorted out. The capacitance at the neutral of the generator (0.48 mfd.) has 6,620 volts impressed and the remaining capacitances on the two unfaulted phases (0.474 mfd. per phase) have 11,500 volts to ground. One of these unfaulted phases leads the faulted phase voltage by 30 deg. and the other lags by 30 deg. The capacitance fault current is therefore

$$\frac{(6{,}620)\ (377)\ (0.48)}{10^6} + \frac{(11{,}500)\ (377)\ (0.474)/3}{10^6} = 4.75 \text{ amp.}$$

The total capacitive kva. is (6.62) (4.75) or 31.4.

Resistor Loss

The transformer secondary resistor is usually designed to have a kw. loss equal to total capacitive kva. to limit transient voltages as discussed later. Neglecting the inductive reactance in the generator and grounding transformer, the current through the grounding transformer will be 4.75 amp. at right angles to the capacitive current of 4.75 amp. Therefore, the total fault current is 6.71 amp. Current and voltage rating of the resistor is dictated by the voltage rating of the transformer. The high-voltage winding is rated for line-to-line voltage of the generator even though the maximum dynamic voltage to be impressed on it is normal generator line-to-neutral voltage. Therefore, in this case, a transformer is used with a rating of 11.5 kv. to 440 volts or a ratio of 26:1. The current in the resistor, for a line-to-ground fault on

the generator terminals, will therefore be (26.1)(4.75) or 124 amp. For a loss of 31.4 kw. the resistor must be designed with 2.04 ohms resistance.

Usually the time rating of the resistor is for five minutes at full current; this is true even in cases where the generator is to be tripped immediately upon indication of a fault. This practice is fully justified since it entails only a small additional cost and provides a more rugged device. Where the generator is not tripped, but an alarm is given when a fault appears, the resistor should be continuously rated.

Transformer Rating

The kva. rating of the distribution transformer is determined by the length of time the fault is allowed to persist. Since actual dynamic voltage applied to the transformer equals rated voltage of the transformer divided by 3, the current rating of the transformer is the dictating factor. Safe time-current ratings for oil-immersed and air-self-cooled distribution transformers for this type of application are as follows:

Time	Transformer Load in Times Rated Current
30 seconds	6.7
60 seconds	4.7
5 minutes	2.8
30 minutes	1.8
60 minutes	1.6
2 hours	1.4

When applied on the basis that it carries the neutral current of 4.75 amp. for five minutes an 11.5-kv. transformer having a rating of $\frac{4.75}{2.8}$ (11.5) or 19.5 kva. is required; this means a 25-kva. standard transformer would be the minimum size. A practical rule to follow applies a transformer whose kva. rating comes nearest to equaling the kw. loss in the resistor; in this case, the rule calls for a 37.5-kva. unit. Of course, it is perfectly safe to operate the grounding transformer at higher overloads for shorter periods of time as shown in the table for transformer loading. It is not necessary to place the transformer directly under the generator; it may be connected to the neutral by cable and can be conveniently located in any suitable space nearby.

Either current or voltage from the transformer secondary may be used for relaying.

If current is used, a 100/5 current transformer would be suitable for the above current of 124 amp. Using a 0.5-amp. overcurrent relay, line-to-ground faults in all parts of the circuit will cause it to operate except for about the last 10 percent of the three phases of the generator at the neutral. Similar protection can be obtained through use of a special voltage relay which operates at 10 to 100 percent of transformer secondary voltage; in the above case, 440/3 or 254 volts is 100 percent voltage.

Tests were made to check the capacitance value calculated for the various generators. Isolated from the system, each generator and its connected transformer bank were subjected to a ground on one phase of the generator leads; no neutral connection of any kind was used. Then with the generator in operation its field was increased until the phase-to-phase voltage was approximately equal to the normal phase-to-neutral voltage; this value was carefully maintained to avoid overstressing the generator windings. Ground-lead current was read at a given voltage and these two values determined the capacitance to ground as follows:

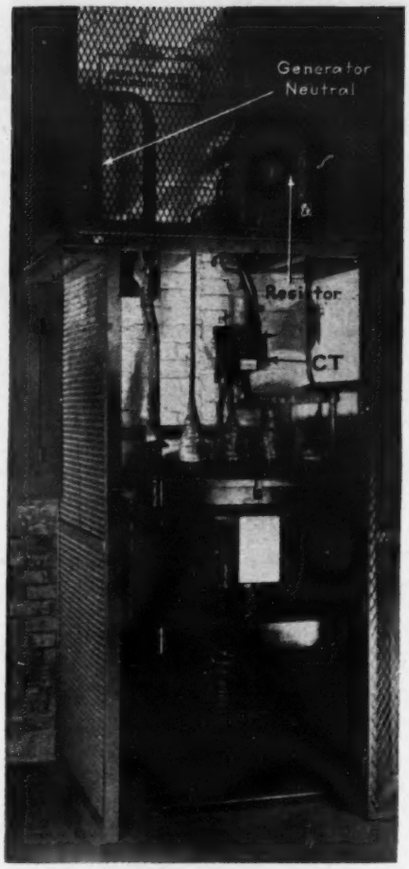


FIG. 2—Distribution transformer placed in generator neutral with resistor grid in its secondary to limit fault ground currents

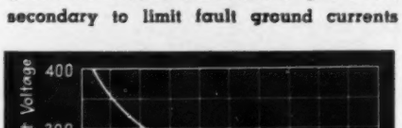


FIG. 3—Transient voltage in percent of rated peak line-to-ground generator voltage

Phase-to-phase voltage of generator, volts	6,000
Current in ground lead, amp	2.28

Since 2.28 is the resultant current of the two unfaulted phases to ground added at an angle of 60 deg., the current from each phase to ground is 2.28/1.73 or 1.32 amp. at 6,000 volts, 1.32 amp. represents a capacity impedance of 6,000/1.32 or 4,550 ohms. Total capacitance to ground of each phase is then $10^6/4{,}550 \times 377$ or 0.583 mfd. The total calculated value of 0.634 mfd. for this generator was 109 percent of the test value.

Tests were made on a second generator in which the calculated value was 0.862 mfd. and the test results gave 0.788 mfd. Here again the calculated value was high, approximately 9 percent above the test value.

Voltage Considerations

This method of grounding a generator prevents the occurrence of high transient voltages which may result from arcing faults or generator circuit switching. Fig. 3 shows, for the example discussed under calculations, that the peak transient voltage is about 2.6 times the peak line-to-ground voltage. If the loss in the resistor is decreased (by increasing the ohms in the resistor) the transient voltage will increase, whereas if the loss is increased above the capacitance kva. there is no important change. These results are about the same as will be obtained for other applications of this type of grounding. In addition, with this type of grounding, any harmonics present in the potential indication will be swamped, the possibility of ferro-resonance with an unshunted transformer is avoided and false tripping of relay, due to capacitive coupling through the main power transformer during single line-to-ground faults on the high-voltage line, is prevented except in some very special cases. False tripping due to capacitive coupling is practically eliminated because the generator neutral impedance is very low compared with the capacitive reactance between high- and low-voltage windings of the main power transformer.

Because of the small generator-winding fault current there is very little or no burning of the iron; thus, some operators choose to delay the tripping of the generator until its load can be removed. This is accomplished through use of a timing relay; it trips the generator in a specified time in case it has not been manually removed from service.

Pulverized-Coal Boiler Art Recorded in A.S.M.E. Symposium

Performance of modern furnace and boiler designs up to 2,500 psi. in major utility plants reported in committee symposium along with researches on heat transfer and properties of coal-ash slags

A. E. KNOWLTON, Associate Editor

A DOZEN PAPERS at three of the sessions of the annual meeting of the A.S.M.E. in New York (November 29 to December 4, 1943) provided the framework for discussion of the efficacy of large steam-generating units burning pulverized coal. The symposium was under the sponsorship of the special research committee on furnace performance factors and the divisions of fuels, power and heat transfer of the society.

The 2,500-psi. unit at Twin Branch, after modification, is reported to be operating up to design expectations; in fact, its 10,035 B.t.u.-per-kw.-hr. achievement sets a 34 percent efficiency goal previously credited only to diesel performance. As vouchsafed by Philip Sporn in ELECTRICAL WORLD of October 18, 1941, the unit has proved technically and commercially sound.

Lessons learned in plants in Chicago, Detroit, New Jersey, Philadelphia and New York add likewise to the knowledge of circulation, heat absorption, superheat control, slag deposits and critical factors. Meanwhile, research on heat transfer and the viscous properties of slag afford new information which is aimed at perfecting designs to meet the variables of unit loading and fueling.

Twin Branch Installation

Since April, 1943, the 2,500-psi. steam-generating unit at Twin Branch has been operating at the design values of capacity, pressure and temperature. It is said by its sponsors to be the most trouble-free installation on the American Gas & Electric systems, has shown favorable availability (96.7 percent) and, in short, is meeting the technical and commercial expectations. It had first been placed on the line in March, 1941. In the interval there have been two major outage periods, both scheduled months in advance to execute indicated changes.

Circulation tests showed values exceeding the calculated performance and it was asserted that the problem of providing adequate natural circulation in boilers operating at pressures up to 2,500 psi. has ceased to exist. Steam purity is as good as or better than the majority of units operating at 1,400 psi. and below and the turbine-blade deposit experience is as good as or better than the majority of units operating at 1,250 psi. and below. A slow building up of stage pressure in the high-pressure unit is corrected by dropping the primary steam temperature to about 750 F. for two or three hours.

Temperature and heat distribution among the various portions of the total heat-absorbing surface proved to be the real problem. It proved necessary to install superheater and reheater surface in zones of higher gas temperature than is usual on boilers operating at lower pressure levels. Superheat- and reheat-surface absorption rates exceeded the design expectations at 52,000 kw. output; thus in order to keep final steam temperature down to design levels it was necessary to employ more than double the calculated full-load attemperation. Quick temporary changes were completed by June, 1941.

Subsequent operation showed circulation to be 45 percent over design values and there was some instability of water level, along with occasional shots of carryover. Normal level, gage glasses and cyclone separators were raised in the next outage (February to April, 1942). Alternate tubes were removed from portions of the first division wall and placed over the reheater tubes in the first open pass to reduce reheater absorption. Second division wall tubes were changed from 4 to 3½-in. (6-in. centers) full-studded or flat-studded. Reheater tubes in rear wall were covered with a new water wall.

Shortly after returning the unit to service two tubes in the first division wall failed, due to high absorption-rate stresses. Stud plates were applied to the upper 15 ft. of primary-furnace-wall tubes to provide protection of the pressure parts against capricious behavior of slag on the hotter zones. Retractable blowers were provided in the second open pass.

No problems in boiler-feedwater chemistry arose. Turbine vibration due to oil whip was corrected by jack bolts to load both halves of the bearing under all loads. Boiler feed pump vibration was eliminated by adjustment of balancing-drum clearances and better shaft alignment. Labyrinth leak-off pressure was dropped from 150 psi. to 90-110 psi. for longer packing life. High-pressure feedwater heater behavior has been entirely satisfactory; they can now be cleaned chemically while in operation.

The foregoing points are from three papers by Sporn and Bailey, Rowand and Allardice, Ely and Schueler.

Credit Accorded

Discussion evoked many plaudits for the courageous pioneering and the candor with which the minor shortcomings were acknowledged and the corrections detailed. I. E. Moultrop, pioneer with 1,200 psi., said in particular he was impressed by the

simplicity of operation by instruments with "no one near the boiler." J. C. Hobbs said the 2,200-psi. unit of Diamond Alkali was in its fifth year without forced shutdown. There were tube cracks attributed to the thermal stresses which Sporn had traced to high absorption following slag-patches sloughing off. Glenn Warren (General Electric) commended American utilities for turning out six times as many kilowatt-hours in this World War as in the earlier one and with only twice as much coal; despite the recent asymptotic progress in the national average the 60 percent difference between it and Twin Branch offers plenty of challenge.

W. H. Armacost (Combustion Engineering) entered certain parallel experiences with the forced circulation boiler at Montaup. Quite flat curves were shown for steam superheat and reheat temperature, gas, carbon dioxide and preheated air from 300,000 lb. per hour to the 650,000 attained. No steam entrapment in downcomers is experienced; circulation ratio is five (against Twin Branch ten). Both Armacost and Bailey welcomed the rivalry between forced and natural circulation exemplified by the two pacemaking stations; more of each type may settle the issue, if there is one.

In closure, Sporn explained that attainment of the 10,035-B.t.u. figure was secondary to getting the most economically produced kw.-hr. in a keenly competitive territory. It was the relatively high price ($3.45) for fuel which made the good thermal economy a cognate objective.

High-ash Coals

Slag-fouling from Central Illinois coal has led to progressive design for boilers in Chicago stations (Michel, Commonwealth Edison) in 375,000-, 425,000- and 750,000-lb.-per-hour ratings. Fuel is free burning, high in volatile, of low ash fusion temperature; its content of moisture, ash and sulphur are high and grindability is low. To meet these characteristics the designs have moved toward low furnace heat release, relatively low entering gas velocities to convection tube banks, gas temperature below ash-softening temperature where gases enter convection banks, provision for mechanical blowing, lancing doors.

Philip Sporn spotted several high points in the relationship between furnace geometry and range of superheat temperature with loading. Automatic regulation is expected to narrow the spread on certain American Gas & Electric system units.

Eleven years of pulverized-coal firing on Public Service Electric & Gas system led H. Weisberg to suggest the following items for study by the committee: Burners, arrangements for maximum heat absorption, methods for predicting and controlling slag deposits, measures to eliminate destructive action of gases and slag on water-cooled surfaces. Circular turbulent burners are deemed superior to rectangular from standpoint of slag accumulation and tube wastage. Anomalous excesses and deficiencies of air and inequal temperature distribution across gas streams are found.

Detroit Edison reported no serious slagging trouble on any tube surface in two Trenton Channel boilers (installed in 1927 and 1929) when burning coals having an ash-softening temperature of 2,500 F. or higher. Nodulized ash deposits in front convection banks, when encountering ash of 2,300 F. or lower, are readily removed every eight hours by steam lancing. When the walls begin to slag, corrective air adjustments can usually be made before slag deposits on tubes. Air lance readily removes the light or nodulized deposits on the water wall tube surfaces in the new boilers at Marysville.

Bypassing is resorted to by Consolidated Edison to assure full temperature at partial load and limit temperature at full load, said W. E. Caldwell, but it gives only a small range of control. Periodic load reduction takes a minimum of labor. Soot blowing or lancing is a necessary supplement with certain coals. Multiple burner ports for coal are preferred. Slags seem to have a sort of plastic hysteresis which involves time for sloughing off.

Slag Problems

Experience at Philadelphia plants (reported by J. H. Harlow) is for units that carry a sustained load at or near their rated capacity most of the time; the fluctuating loads are taken by less efficient plants. Dip in load shortly after midnight amounts at Schuylkill to one-third and lasts for a half-hour—long enough to crack slag from furnace walls—thereby reducing the hand lancing required to keep steam temperature within required limits. Output at Chester is reduced daily to permit slag removal from the upper third of the second pass.

Normal load at Richmond is such that practically no trouble has been encountered in slag tapping. Retractable steam blowers remove screen slag and telescopic water lances clean the lower bank of generating tubes. Hand lancing to the extent of 160 man-hours per week completes the job. Hand lancing at Schuylkill takes 80 man-hours and 55 at Chester. In general, effort is made to maintain an oxidizing atmosphere to prevent tube wastage. It is less where CO is less than ½ percent and greater where unburned carbon is deposited.

Slag vs. Heat Transfer

First disclosure of 15 years of study of coal ash at the Bureau of Mines was made by Messrs. Reid and Cohen in a paper which treated the flow properties of coal ash slags. Rheological researches in conjunction with a rotating viscometer place stress on the temperature of critical viscosity, that at which there is a delineation between fluid and plastic viscosities. So many variables appear in the ash that it was necessary to make synthetic slags from kaolin, quartz, ferric oxide and calcium carbonate. It is found that variation of the state of oxidation of the iron components is one of the most potent factors fixing the temperature of critical viscosity. Further, the ability of slags to remain in the liquid state while being slowly cooled (*i.e.*, behave as a glass) is not as great as was formerly believed. Of 40 compositions tested only one behaved like glass.

Viscosity at the softening temperature is also extremely variable. Nor is there any relation between the viscometric data and the initial deformation temperature. However, it appears that the viscosity at 2,600 F. can be predicted approximately from the cone-fluid temperature. The "softening" and "fluid" intervals probably are less significant than the values of the observed points, no relationship being found between the intervals and the viscometric data. A nomogram was given relating the viscosity in the liquid state as a function of temperature and the composition expressed in viscosity poises corresponding to various silica percentages of total silica, ferric oxide, lime and magnesia.

Fluorescent in Chicago's Subway

CHICAGO'S newly opened State Street subway, first link in a proposed city-wide system, is a pioneer in the fluorescent lighting of underground rapid transit systems. In the amount of light, its uniformity of distribution and control of brightness, Chicago's is an outstanding installation measured by the standards of other subways and has set a new goal for such projects.

When the lighting system was being planned, early in 1939, fluorescent lamps for general commercial installations were in the development stage. For subway service many difficulties had to be overcome before it would be entirely satisfactory for such severe conditions as exist there. For example, perhaps the most serious problem was that commonly used fluorescent lamp starters were not dependable at near freezing temperatures. This was confirmed by tests which subsequently showed the superiority of the thermal type of starter at low temperature—particularly the mogul-size, four-contact thermal starter, which is dependable down to zero degrees F. Ballasts selected are the single-lamp, high power factor type which are mounted in contact with the metal base for dispersal of heat.

Supplementary Incandescent

Throughout the train tubes, between stations, in all service rooms and emergency exits, incandescent lighting is used. Two rows of 60-watt lights are provided, one on each wall of the tube. Lamp spacing is 30 ft., but light strings are staggered so there is a lamp for every 15-ft. interval of tube length. Each outlet is equipped with a simple cast-iron bracket with a right angle shield to prevent interference with the motorman's vision.

Every fourth lamp of these strings is supplied with d.c. current. These lights are connected five in series across 600 volts, but the individual strings of five lights are staggered and on different circuits to insure some light under all conditions. The intervening three lamps are on separate a.c. circuits.

ABOVE PLATFORM EDGES are 40-watt fluorescent units at 7½-ft. intervals, providing about 9 ft.-candles; mounted on soffit are incandescent units for emergency lighting

FIXTURES AT CROWN of arch are on 15-ft. centers; intensity ranges from 6.4 to 9 ft.-candles, average 7.14

MEZZANINE ILLUMINATION averages 5.41 ft.-candles. Units on the 8-ft. ceiling are spaced 10 to 16 ft. apart

Editorials

S. B. WILLIAMS, *Editor*

Stalin's Great Tribute to American Production

"WITHOUT American production the United Nations would never have won the war." This was the toast of Premier Stalin at one of the dinners during the Teheran Conference.

Russia's great leader might equally well have said that without the American electric power, which never once was "too little or too late" for war production, victory might not be ours.

At the recent war conference of the New England governors WPB Executive Vice-Chairman C. E. Wilson pointed to the difference in tempo with which industry moves in war as contrasted with peace. The somewhat leisurely pace of the former is replaced in war by a pace that is terrific. The armed forces are constantly pressing for changes in equipment and supplies, and, as Mr. Wilson put it, the great flexible instrument of American industry has to be arranged and shifted regardless of the convenience and interests of any region or group or individual, and the changes have to be made at once. Under such conditions we cannot afford to establish a rigid production system. One of the great assurances of victory is the exceptional sensitivity of our war industry to the needs of battle and its ability to adapt itself overnight to those needs.

This ability of the American industrial system to change with the pattern of the war, to respond immediately to each alternation in the demands of the fighting fronts, is due to many factors. Individual enterprise is one, resources another. Communication, transportation, standards of living and education for liberty are others. Underlying and penetrating the entire national fabric, however, is electric service, with its superb flexibility.

We speak in awed tones about the accomplishments of our producers of armaments, planes and ships, and they have been marvelous records, but electric service has had to meet the expansion demands of every one of these great war loads pyramided one on top of the other. And it never once has faltered.

While the world pays homage to American industry, which has made victory possible, we once more draw attention to the fact that ample electric power, always available whenever and wherever needed, without the aid of priorities, never curtailed by strike and never reduced in quality, has made it possible for this miracle to be performed.

The men and women of the electric power industry can take great satisfaction in the knowledge that their splendid performance made it possible for Premier Stalin to pay his great tribute to America.

The Utilities' Share of the Coal Miner's Increased Wage

THE UTILITY INDUSTRY last week learned that its share of the tribute paid to the striking coal miners will be somewhere between 13 and 20 million dollars annually. As the result of the increased wages allowed the miners under the new contract OPA has increased the ceiling price of bituminous coal. The average increase, OPA states, will be 17 cents per net ton, but if all the special allowances are added in and the increases averaged on a weighted basis it is possible the average may come nearer to 25 cents per ton.

If a mean of 20 cents increase is taken it amounts to one-tenth of a mill per pound, and since the average fuel consumption is less than one and a third pounds of coal per kilowatt-hour it does not take very long to see how this increase in coal price is reflected in the cost of electric energy. Where the fuel clause operates this of course will be taken care of, but a large part of this increased bill will still be uncovered.

Why Let Somebody Else Get the Credit?

THE EXCISE TAX of 20 percent voted last week by Detroit against the revenues of the local gas and electric companies gives the utility industry something new to think about. The city has been trying for some time to prevent excess profits taxes of Detroit utilities from getting out of the city. After being turned down by the Michigan Public Service Commission, it has turned to the excise tax means to keep in Detroit any excess profits the utilities might have.

If the Detroit ordinance is accepted as not being discriminatory there is nothing to prevent every city in the country from adopting a similar measure. Under the circumstances might it not be well for the utilities to get credit for the distribution of these excess profits taxes

ather than some one else? In Arkansas the commission equires what amounts to a customer dividend as a way o keep such taxes within the state. Perhaps there is merit n such a procedure. Certainly it is to be preferred over ny municipal excise tax.

Of course the federal government gets deprived f money that was levied to help pay the cost of war, but he present administration, at least, has never let federal evenue stand in the way of reducing a utility's charge o a customer. It has encouraged remission of taxes hrough public ownership and has loaned money to REA o-ops to take property off the tax rolls.

Certainly if the utilities offered the excess profits ax or any substantial portion of it to the customers as dividend they would get the credit for lower cost of ervice without having to reduce rates. There is no eason in the world why the utilities should stand in the niddle in this battle, which is not of their making, and et nothing out of it but a black eye.

Boiler Design Components o Be Explored

HARDLY any two boilers in utility plants the country ver are alike unless they were bought simultaneously as leliberate duplicates. Must this be or can there not be ome uniformity despite the inevitable variations in size, uel B.t.u. and steam levels, ash-slag vagaries and a lesirable latitude for developmental progress? While nquiry around the industry reveals little hope that much an be done to alter the present picture of infinite varia- ions in boiler-furnace configuration, some of those who articipated in the A.S.M.E. symposium last week seem not so sure now that the case is quite that hopeless. As one old-timer put it, "Thirty years ago the design of power plants had become an exact science; it still is an exact science—everybody does exactly as he pleases." Even he thought, however, that the work of the society's research committee on furnace performance factors might eventually produce results along the right lines.

This committee is setting out to explore the separate components of the complex problem of furnace design. Its first attack is to be on the geometry of furnace proportions to ferret out the effect the indexes will have on the design and disposition of burners, upon the accommodation to slag characteristics and upon the unsolved problem of superheat control. It is planned to digest field information and set up the inferences on fundamental bases, which will be co-ordinated with the admirable information being obtained by the Bureau of Mines studies on slag. Also, the committee will extend the development of instruments for research on combustion and heat absorption in large boilers. A suggestion offered that may well be incorporated later is that the principles of aerodynamics be brought in to account for dissymmetries in flame temperature, vortical eccentricities of the gases and the anomalous excesses and deficiencies of oxygen at various points around the combustion spaces.

All this is going to call for extensive field study involving manpower and money. Some of both have already been pledged. More will be needed and the utility industry can well give this movement adequate support. It looks like the most promising venture in a long time to converge boiler-furnace design toward fewer patterns that will still recognize the inescapable variables of capacity, fuel and objective steam conditions. A fair idea of the initial efforts can be had from the report of the symposium on another page of this issue of ELECTRICAL WORLD.

Your Help Is Needed

PAPER IS SHORT; there is plenty of paper-making capacity, but a shortage of pulp wood exists because of insufficient labor in the woods. The demand of war is greater and is growing with each boy we send across.

Publishers have already had one cut of 10 percent and will get another 15 percent the first of January. Still it will be necessary to conserve every pound of paper we can.

So far it hasn't been necessary to curtail on our service to readers. We have decreased the margins, used lighter weight paper, frozen our circulation and limited advertising, but we have not reduced our coverage of the field, for we feel that the service of the business and technical press is essential in wartime.

When you are through with this copy of ELECTRICAL WORLD and you have no further use for it please see that it gets in the waste-paper collection promptly. Our greatest source of paper stock today is in the supply of used paper. The more you and other readers help to salvage waste paper the less will be the drain on our short supply of new wood pulp and the less chance will there be of further restriction on the use of paper.

Of course we have a selfish interest in this paper conservation because we are about coming to the end of our ability to meet all of the conservation demands created by war shortages and still not reduce our service to our subscribers. The use of substitutes, used stock, lighter weights of paper, new inks, no staples, and numerous other changes have not been economies—they have involved considerable extra expense, especially when we were determined not to impair any of the readability of our magazine.

We hope we may be permitted to continue to maintain our service to the electrical industry undiminished because of any supply difficulties we may encounter. We will continue, with your help in conservation of paper.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Material Restrictions Beginning to Ease Up

WASHINGTON these days is rife with news, speculation and gossip about the beginning of the end to the restrictions on the use of materials for non-war purposes.

The speculation and gossip, of course, have been going on for months, much of it wishful thinking of the "I can dream, can't I" school, and some of it undoubtedly aimed at building up pressures too great to be resisted.

Today, however, the talk is to be heard as freely in the war agencies as in the press rooms. Even in the hard-boiled Office of War Utilities, manned largely by conservative men who have long displayed a trenchant attitude toward unnecessary use of materials, is the tide running.

New U-1-c

OWU, for instance, is about to amend certain of the supplementary U-1 orders loosening materials restrictions measurably. Already, applications on form WPB-2774 for rural lines in excess of 5,000 feet are processed to allow the more liberal use of copper conductor which may be had from excess stocks. U-1-c is to be amended to allow this for rural lines of less than 5,000 feet, junking present restrictions which require primary line to be of No. 6 galvanized steel purchased from the mill, or copper-covered steel, No. 4 composite or salvaged wire of any kind equal to or less than No. 6 copper in conductivity, all of which may be purchased only from excess stocks.

Under the new U-1-c, primaries, secondaries and service drops may be of any type or size conductor which is available in excess inventory, or of any type or size conductor having a conductivity equal to or less than No. 6 AWG copper if purchased from a commercial supplier. There is no OWU move to relax the restrictions on animal units, but the Agriculture Department has ideas about relaxing such restrictions and is ready to suggest further amendments of U-1-c to OWU at any time it thinks it can get them accepted. These would reduce the required animal units per mile from 53 to, say, 35.

Residential Extensions

It is proposed to amend U-1-f to allow extensions to any domestic consumer rather than only to those living in housing shortage areas. Other restrictions, such as the $500 and $1,500 limitations on materials value, would still apply. Conductor standards would be substantially the same as proposed for U-1-c.

Order U-1 itself probably will be amended to delete restrictions on withdrawals from inventory. This move, intended to save utilities many man-hours of report preparation rather than to ease up on materials, would allow utilities to use materials on hand for work not otherwise prohibited. Such prohibitions as those against adding to plant and against unnecessary maintenance would still apply, but with dollar value restrictions on withdrawals removed a utility could replace overloaded transformers or carry out similar work which normally would be done but which has been deferred because it couldn't be fitted in with the absolutely necessary work under the dollar value restrictions on withdrawals.

None of these relaxations will constitute an immediate return to the good old days, and whatever additional material they entail will come from inventory rather than from manufacturers. The trend is conservative and in no way an indication that the war is to be over next week or that business as was usual in 1941 may be expected tomorrow. It is a recognition that the days have passed when every nut, bolt and washer had to be hoarded against the possibility that the war would take so disastrous a turn that not an ounce of non-war material would be available beyond the limits of inventory.

Relaxing Restrictions

Equally effective in relaxing material restrictions, though not formal as is the amendment of supplementary orders, is the fact that with the war power program largely out of the way, standards on which projects have been considered in the past two years—and they were ruthless in OWU—are being relaxed somewhat by the men who handle them, without any change in the written standards. An example of this is the treatment recently accorded a request for a boiler to augment the tight local situation in a war-swollen Southern city. The project had been up before and rejected because it was not quite a win-the-war proposition in the days when it was a win-the-war matter to get a boiler on the schedule of any manufacturer.

Boiler schedules are still tight, but places can be found for a few if they are really needed. Again this does not presage an opening of the floodgates on all projects which ever were turned down, but a very few which just lost out in the past can be handled now. As time goes by, this trend will become more and more prevalent.

Appliances

Appliance production also is coming, but it will come under conditions far from business as usual. The Office of Civilian Requirements announced hopefully last week that it expects authorization for 64,000 three-element electric ranges in 1944. But the range program proves to be aimed at "the most essential needs of the armed services, hospitals, FPHA and FHA housing projects and to provide essential replacements for civilians who have been or who now are using electric ranges."

On these terms, it is clearly indicated that range production, and this holds for all other appliances, will fall far short of anything like normal volume.

NEWS OF THE WEEK

Office War Utilities Simplifies Order U-1

***One order canceled and four others amended as Order U-1 is brought up to date — Changes will* eliminate paper work**

One order was canceled and four more were amended this week as the Office of War Utilities simplified and brought up to date its series of orders supplementary to Order U-1.

U-1-b, governing the extension of service to cooking appliances, was canceled, with its principal provisions transferred to Orders U-1-d and U-1-f. U-1-a, U-1-c, U-1-d and U-1-f were amended.

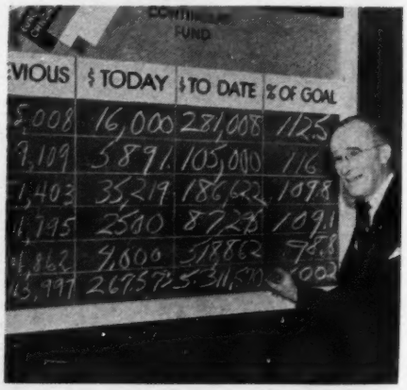
Paperwork Eliminated

The changes will eliminate considerable paper work by providing automatic authorization in conjunction with U-1-h for extensions to essential commercial and industrial consumers as listed where the total material cost does not exceed $5,000 and for domestic consumers who can be served with the expenditure of not more than 1,000 conductor feet of line, or under the housing utilities standards, depending on the applicable supplementary order. Numerous restrictions on the weight of material allowable for extensions under the various supplementary orders were summarily junked on the ground that if no weight restrictions were to be imposed under U-1-h, which provides automatic authorization for major extensions ($500 to $5,000), (ELECTRICAL WORLD, November 6, 1943, page 5). There was no point to maintaining such restrictions on the minor construction allowable under the other supplementary orders.

The amended orders reflect to a conservative degree the increasing availability of materials.

U-1-a, which provides automatic approval for extensions to serve Army, Navy and Maritime Commission needs, has been broadened to include the War Shipping Administration and the Civil Aeronautics Authority. In addition, the provision limiting to 250 feet the allowable length of any U-1-a extension has been deleted.

Types of conductor which may be used for extensions under U-1-c have been broadened considerably. Under the new U-1-c, primaries, secondaries and service drops may be of any type or size conductor which is available in excess inventory, or of any type or size conductor having a conductivity equal to or less than No. 6 AWG copper if purchased from a commercial supplier. The purchase of copper from suppliers was authorized because of the scarcity of steel wire. The order is drawn to encourage the use of conductor available in excess, and permits the redrawing of solid copper conductor to meet the conductivity requirements.



FUND CHAIRMAN—Pressley H. McCance, president of Duquesne Light Co., was chairman of Pittsburgh's United War Fund Campaign, which last week went over the top in its annual drive for funds with a total of $5,311,579

Pound Limits Deleted

Pound limits of material for use on secondaries and drops have been deleted, and goats and kids have been included in the animal unit table, with six milk goats, or 30 other goats or 160 kids per year equal to one unit.

In amending U-1-d, OWU deleted the weight limits on allowable material for extensions to industrial and commercial consumers, replacing them with design standards requiring the minimum feasible use of materials. The former U-1-b prohibition against the erection of service to a cooking appliance which would displace an existing and usable service was included in U-1-d and U-1-f. From U-1-f was deleted the provision that eligible domestic consumers must live in a housing shortage area, and the list of industrial and commercial consumers who may be served under U-1-f was broadened. The utilities construction standards of U-1-f were amended to encourage the use of material available in excess inventory and to provide about the same types of wire for domestic consumers as are provided in the amended U-1-c. Weight limits on domestic and commercial extensions were dropped.

A.S.M.E. Meetings Reveal New Technical Advances

Turbine governor specifications soon to be standardized and metals for higher steam and furnace temperatures are in prospect — Gas turbines now a reality

Gas turbines are a reality, fly-ash can profitably be disposed of, metals for higher steam and furnaces temperatures are perhaps in prospect, turbine governor specifications are moving toward standardization. These are some of the technical contributions of interest to the power field which highlighted papers and discussions at the annual meeting of the American Society of Mechanical Engineers in New York, November 29 to December 4, 1943. A report on the status of pulverized-coal boiler technology appears elsewhere in this issue.

Gas Turbines a Fact

"We have arrived at the point where the gas turbine is a fact," said R. C. Muir, General Electric, in his comment on the paper "Gas Turbines and Turbo-superchargers," by Sanford A. Moss. The same thought was expressed by A. G. Christie, Johns Hopkins, who remarked that those who are skeptical as to the gas turbine will probably be greatly astonished when the curtain of wartime secrecy is lifted.

In his paper Mr. Moss stated, in relation to the likely results from operating studies of superchargers in war use, that:

"The long-sought gas-turbine prime mover, with temperatures much beyond the 1,000 deg.F now in use, seems to be getting nearer. Of course, this same progress is paving the way to higher temperatures and higher efficiencies for the regular steam cycle and two-fluid cycles. So we can only speculate as to whether the gas turbine, with its compressor, combustion chamber and heat interchanger, is going to compete with the other cycles which instead have economizers, feedwater, heaters, feed and air pumps, boilers and condensers."

The first uses for the gas turbine were foreseen by J. T. Rettaliata, Allis-Chalmers, as in the marine, heavy traction and aircraft fields. For central station power plant applications he mentioned the possibility of use of powdered coal instead of liquid or gas fuel. Paul R. Seidler, Brown-Boveri, championed the axial-flow as against the centrifugal air compressor as a gas turbine component which, he predicted, would soon invade the fields of the steam turbine and the diesel engine. Extremely high temperature is not a necessary factor in successful gas turbine design, Frederick Nettel, consulting engineer, asserted and went on to say that a machine of around 30 percent efficiency and with gas temperature of no more than 1,050 deg.F was perfectly practicable.

Related in interest to the gas turbine discussion was the paper by E. G. Peterson, Peabody Engineering, on "Firing High Pressure Furnaces" in which combustion chamber pressures up to 55 psi. and heat release rates up to 2,500,000 B.t.u. per cu. ft. per hour were disclosed.

Detroit Edison for many years has been exploring the potentialities of fly-ash as a salable product. The study has arrived at fruition, according to a report by C. M. Weinheimer at a fuels session. The material is being used for concrete highways, as filler in bitumastic road surfaces; a large industrial building has been built entirely of concrete based on fly-ash. A price of $1 a ton is sought for bulk deliveries (4½ tons pumped from truck in 40 minutes) and about $3 in bags. It improves long-term strength of conventional concrete and facilitates a new lightweight concrete. The Marysville plant has storage for 1,600 tons; a daily demand of 80 to 100 tons is not unlikely during construction months. If the reluctance of the rubber and plastics industries to use the ash as filler could be overcome the seasonal problem of profitable disposal would be solved.

Governors Discussed

Further discussion of the specifications for prime-mover speed governing recommended by a joint A.I.E.E.-A.S.M.E. committee at one of the sessions answered certain of the comments made since the proposals were launched at the A.I.E.E. convention at Cleveland in June, 1943. After A. P. Schwendner of Westinghouse had outlined graphically the meaning of the proposed definitions three General Electric engineers treated significant items. E. E. Parker sees a serious drawback in defining over-all regulation in terms of rate rather than maximum, valves-wide-open load (the present practice) and wants also to see a 4 to 5 percent value. Economy and stabilized boiler room operation seem to call for the wider latitude. Raymond Shephard said narrow range governors have to take the load fluctuations and many extant could not work safely at 3 percent, although many modern ones have that attribute. J. B. McClure cited the photoelectric frequency recorder and the Allen method for graphing dead-band.

Glenville Turbine

Service of the 2,000-kw. local load of the Nantahela Power Company when detached from the Alcoa-TVA load cre

Press Association, Inc.

ENGINEERING LEADERS AT ANNUAL MEETING—Robert M. Gates (left) president, Air Preheater Corp., of Scarsdale, N. Y., president-elect of the American Society of Mechanical Engineers; Charles F. Kettering, vice-president of Research of General Motors (center), and Harold V. Coes, retiring president of A.S.M.E., are shown at the 64th annual meeting of the society in New York City

ated an unusual regulating problem for the 1,150-foot head, 30,000-kw., 257-r.p.m. double-wheel Glenville unit in North Carolina. The critical time for the 16,000-foot penstock is about eight seconds and a jet deflector is used in conjunction with the 100-second needle valve to avert undue pressures with drop of load. A stilling pool functions when jets are deflected. Impulse wheel efficiency is 88.9 percent and over-all generation efficiency 87 percent, according to Arnold Pfau (Allis-Chalmers). In discussion Robert Lowy (Baldwin-Southwark) suggested that reliance on overspeed safety devices (as in Europe and even here for steam turbines) would substantially reduce the money spent for strength to withstand runaway speeds.

Metal Corrosion Results

Five years' testing of 46 different metals and alloys in superheated station steam for 4,000 to 16,000 hours to determine relative resistance to corrosion was reported by Messrs. Rohrig, Van Duzer and Fellows of Detroit Edison. Results indicate that weight loss of plain carbon steel at 1,100 F. continues at a high rate, but that rate of loss of alloyed materials decreases with time. The high chromium-nickel and the 12-chromium stainless steels were the most corrosion-resistant. Corrosion rate of 0.50-molybdenum and 1.0-chromium steels compared favorably with that of 5-chromium steels. Materials which corroded rapidly at 1,100 F. corroded only slightly at 925 F. and there was little difference found at this lower temperature between the rates of corrosion of plain carbon and alloy steels.

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Court Sustains Utility on PUD Wholesale Rates

Superior Judge John M. Wilson in Olympia has recently sustained the state Public Service Department in its refusal to compel the Washington Water Power Co. to furnish public utility districts with wholesale rates.

The department had sustained the company's demurrers to the complaints on three grounds: (1) That the department had no jurisdiction; (2) that the utility districts had no legal capacity to sue, and (3) that the complaints did not state sufficient facts to constitute a cause of action.

The complainants are public utility district No. 1 in Okanogan and Douglas counties. Condemnation proceedings to acquire facilities from the power company are now pending in the courts.

Detroit Adopts Excise Tax on Gross Revenues

Controversial measure becomes law by vote of 8 to 1—Purpose is to divert federal excess profits taxes of utilities to the city of Detroit for post-war schemes

The Detroit city council, by a vote of 8 to 1, has passed the controversial proposal advanced by Corporation Counsel Paul H. Krause to levy a 20 percent excise ordinance tax on gross revenues of local privately owned utility companies.

"We didn't expect the council would pass this ordinance. We still think it is unfair and discriminatory, but we will not make any statement right now as to our next step," said Alfred C. Marshall, president of Detroit Edison Co., who was immediately interviewed after passage of the law became known.

The purpose of the new tax measure, according to the corporation counsel, is to divert federal excess profits taxes now going to Washington back to the city of Detroit for the purpose of financing post-war work. The new legislation is aimed at two of Detroit's public utilities, the Detroit Edison Co. and the Michigan Consolidated Gas Co. The city recently lost a rate case against Detroit Edison before the Michigan Public Service Commission in which the same issue was involved.

In its official statement, sent to the city council while the proposal was under consideration, but before passage of the ordinance, Detroit Edison stated: "This company has over 450,000 customers in Detroit. More than 400,000 are residence customers. Our rates to them are among the lowest in the country. But even with the low rates they cannot stand this 25 percent increase. It is unjust, unreasonable, impossible. It is our solemn duty to our ratepayers and to our stockholders to protest this unjust and discriminatory tax and to contest its validity in the courts if it is enacted by ordinance."

Argument Against Ordinance

The official statement of the Detroit Edison Co., in pursuing its argument against the excise tax law, continues: "While it is true the greater portion of the tax will come from the federal government, it must also be remembered that for every $81 which would otherwise go to the federal government $19 comes directly out of the Detroit Edison Co., for the reason that the excess profits tax is but 81 percent.

"This proposed 20 percent tax would yield approximately $10,000,000 to the city of Detroit. Of this $10,000,000, $8,100,000 would be diverted from the federal government to the city, but $1,900,000 will come out of the net earnings of the Edison company. . . The company's customers will be required to pay this tax. Since the Public Service Commission has just found that the Edison rates are not unreasonable, this commission would undoubtedly authorize a rate increase sufficient to maintain the net earnings of the company at about the present level."

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Post-war Program For Better Light Bureau

Plans are getting under way for an expanded post-war program of public education on the relationship of light and sight, it was announced last week by H. P. J. Steinmetz, chairman of the National Better Light—Better Sight Bureau.

Two important committees—a home-lighting planning committee and a commercial and industrial lighting committee—are being appointed to prepare plans, programs and materials for availability to the lighting industry.

The home-lighting planning committee, already functioning, consists of a personnel with broad experience and judgment selected from the various interests most concerned with light development. Its membership includes Harry Restofski, West Penn Power Co., chairman; J. M. Stedman, Pennsylvania Power & Light Co.; H. A. Stroud, Monongahela West Penn Power Co.; Henry G. Clum, Jersey Central Power & Light Co.; Mariquita Dygert, Detroit Edison Co.; Myrtle Fahsbender, Westinghouse Lamp Division, and E. W. Commery, General Electric Co.

"We are confident that out of the deliberations and recommendations of these two committees," states Mr. Steinmetz, "the bureau will be able to present to the lighting industry suggestions and materials for the greatest educational drive on Better Light—Better Sight in the history of the electric industry."

Labor Areas to Determine Limited Appliance Output

Only manufacturers in areas where labor and facilities are available will be allowed to resume production — Manufacture of consumer durables on industry-wide basis out for duration

Manufacturers in areas where labor and facilities are available will be chosen for the slowly developing program of production of consumer durable goods, the Office of Civilian Requirements indicated recently in a statement forecasting the resumption of manufacture of electric ranges on a limited scale next year.

Authority Expected

Announcing that it expects to receive authorization for the manufacture of 16,000 three-element domestic ranges per quarter through 1944, OCR lent strength to the belief current in Washington that as manufacture of civilian good is resumed, it will be in areas and by firms having no war work to do rather than on an industry-wide basis as before the war.

With munitions cutbacks becoming increasingly pronounced and with some official Washington quarters concerned over possible unemployment in as short a time as three more months, it appears more and more likely that those consumer durable goods which are made before the war ends will come from those plants which for one reason or another are dropped from the list of arms producers.

In the meantime, appliance manufacturers who are on war work and do not suffer contract cancellations will remain on their war work regardless of competitive possibilities, according to current thinking. With the cut in war production expected by responsible officials to be as high as 50 percent at the conclusion of the European war, it is generally felt that no manufacturer will be too badly hurt by this arrangement. This is bolstered by the fact that many manufacturers of durable goods are concentrating most of their war work on munitions, which will be most heavily cut back at the end of the European war. Ships, aircraft, communication facilities and radio equipment are expected to suffer least by the cutbacks.

The range program will total about 10 percent of the 1941 production if it is approved, with the output allocated to the armed services, federal housing projects and as replacements for essential civilian users. Only a few of the 24 manufacturers who were in the business in 1941 can expect to share in the program, OCR emphasized, with the work going to those who can do it with the least drain on facilities and manpower needed for war work.

WPB also allocated material for the production of 200,000 barometric dampers for domestic space heaters, 400,000 barometric dampers for domestic central heating plants, 20,000 control sets for commercial heating plants and 15,000 barometric dampers for commercial heating plants. The authorization was sought by OCR as a means of saving fuel.

Manufacturers in labor areas 3 and 4 will be favored for this program over those in areas 1 and 2. Only those manufacturers who can show that the program will not affect their war contracts will be allowed to do the work, and any who participate will have to show that they can get the instruments completed in time for service in this year's heating program.

COMMONWEALTH EDISON "SCRAPPER"—Walter A. Schellhorn, 47-year-old employee of Commonwealth Edison Co., was crowned state champion "scrap spotter" by WPB salvage officials recently. Schellhorn has been instrumental in unearthing more than 3,700,000 pounds of metal for the war effort. His citation of merit is being presented by William L. McFetridge, Chicago area salvage director

Ontario Power Project Now in Operation

The Ontario Hydro-Electric Power Commission announced last week that its new $1,500,000 120-mile transmission line between Port Arthur and the Steep Rock Iron Mine in northwestern Ontario has gone into operation.

The line will provide power to operate the pumps which will drain an estimated 100,000,000,000 gallons of water at a rate of 300,000 gallons a minute from Steep Rock Lake preparatory to starting operations at the rich hematite iron deposits. It will also supply power to the Ontario-Minnesota Pulp & Paper Co., Ltd., to replace power formerly generated by the company's own power plant which had to be closed before the lake could be drained.

The line, constructed within six months, is of twin wooden pole construction, Western cedar replacing the usual steel poles because of the scarcity of steel.

Electric Companies Sue

Charging the General Electric Co. with violation of the Clayton anti-trust act, five independent electric light manufacturers filed suit in the federal court in Newark this week. The companies asserted General Electric monopolized or attempted to control the manufacture of electric light bulbs and parts.

OPA Increases Soft Coal Ceiling Prices

Increases averaging 17 cents a ton affecting 17 districts authorized last week — Result of new contract between Solid Fuels Administrator Ickes and United Mine Workers

Increases in ceiling prices of bituminous coal averaging 17 cents a ton and affecting 17 of 22 producing districts were authorized last week by the Office of Price Administration as a result of the new contract proposal agreed to by Solid Fuels Administrator Harold L. Ickes and the United Mine Workers of America.

Few Districts Omitted

In five districts no general increases were provided for, but increases of 20 to 25 cents a net ton were allowed to cover underground handling costs. The new ceilings, OPA made it clear, do not cover the full cost increases resulting from the new contract proposal in those districts where the financial position of the operators is such that a part or all of the cost boost can justifiably be absorbed. Increases were granted on the basis of principles outlined for OPA by Economic Stabilizer Fred M. Vinson.

Increases by districts were as follows:

Districts 13, 20 and 22, 10 cents a ton; district 3, 15 cents; districts 2, 4, 8 and 19, 20 cents; districts 6, 7 and 16, 25 cents; districts 1 and 12, 30 cents, plus further increases of 25 and 30 cents a net ton respectively to cover costs incurred by the beginning of six-day weekly operations; district 23, 35 cents; district 14, 40 cents, and districts 5 and 18, 50 cents.

No general increases were provided in districts 9, 10, 11, 15 and 17, but 20 cents a net ton was allowed for hand loading in districts 9, 10 and 11, 25 cents a ton was allowed for underground mines in district 15 and 20 cents a net ton was allowed underground mines without rail connections in district 17.

Total Production High

Meanwhile, the new contract was credited with the high production of 12,450,000 tons of coal, which was produced during the week ended November 27. Although the figure was 250,000 tons below that of the previous week, the loss was attributed to the Thanksgiving holiday, and the total production was higher than had been anticipated, surpassing numerous full weeks worked before the contract was agreed to. The Thanksgiving Day production of 1,656,000 tons was produced by the largest turnout of miners on that holiday in history, Ickes asserted, adding: "Coal production is now headed in the right direction, thanks to the new wage agreement . . . but we are a long way yet from having an adequate wartime fuel supply . . . we must get bituminous coal production up to or above the 13,000,000,000-ton mark and keep it there for as long as necessary."

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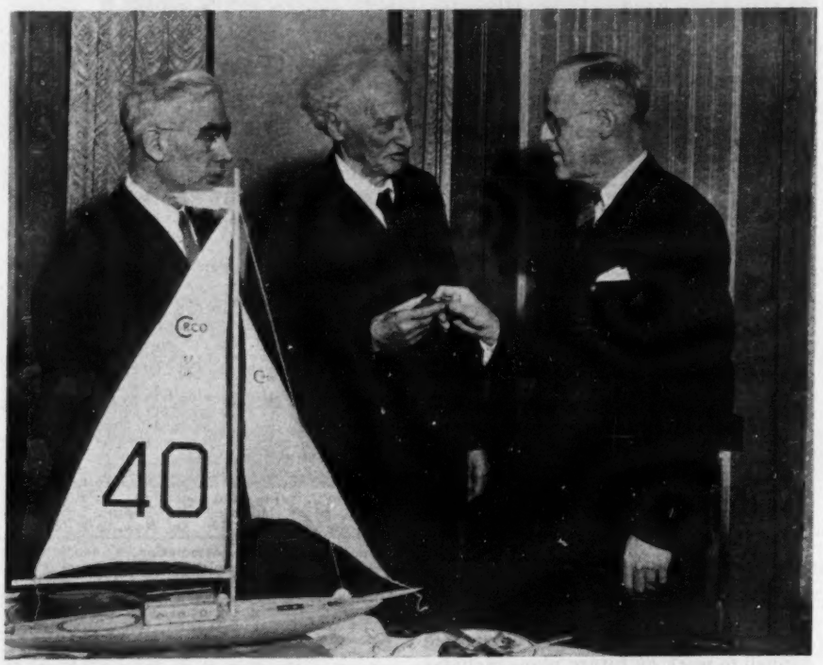
OWU Amends Conservation Plan

On unanimous recommendation of the task committee which developed the program, the Office of War Utilities has amended its voluntary conservation program to allow the burning of indoor and outdoor promotional, advertising and display sign lighting from dusk until 10 p.m. nightly.

The relaxation, first of the campaign, is expected to improve co-operation considerably. Previously, such lighting was restricted to two hours nightly between dusk and 10 p.m. It was felt that this restriction was the one at which most non-cooperating business houses balked, and by allowing usual lighting during the evening hours, OWU officials and the industry task committee expect to get more wholehearted co-operation with the remainder of the campaign.

While the two-hour night lighting period was adopted widely in some cities, in most such cases merchants sooner or later gave up in disgust at reports that there was no co-operation with the campaign in other cities. Philadelphia, which opened the electric conservation campaign with some of the best compliance in the country, was an outstanding example of this. In Washington, where almost no compliance was to be found for the first month of the campaign, much daytime but little nighttime lighting has been extinguished. Since the tendency to go along with daytime curtailment is so much broader than that to accept nighttime restrictions, OWU figures to save and strengthen the daytime compliance at the expense of admitting defeat on the night-lighting provisions.

The new provision governing night advertising, promotional or display lighting reads as follows: "Reduce



SERVICE AWARD PRESENTATION—Stephen M. Ryder (center), 85-year-old president of the Chisholm-Ryder Co. of Niagara Falls, N. Y., receiving a twin-diamond-studded Old Timers' pin, denoting a continuous service in one organization for 40 years, from George O. Benson (right), manager of the Premax Products Division as Robert Pearce (left), president of the Old Timers' Club looks on

burning hours so far as practicable, but in no case burn after 10 p.m. in terms of local time." The new provision for night show window lighting which does not provide essential interior illumination is identical. Daytime restrictions for these classes remain the same —eliminate completely.

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Virginia Utilities Involved in Deal

Donald C. Barnes, president of Engineers Public Service Co., announced this week that the Virginia Electric & Power Co., a subsidiary of Engineers Public Service, has agreed to buy all the common stock of the Virginia Public Service Co. from the General Gas & Electric Corp. for $1,000,000 plus up to $1,500,000 additional from future earnings.

The sale is contingent upon authorization by the stockholders of Virginia Electric & Power of new class $5 dividend preferred stock and the procurement of $3,800,000 additional bank loans in addition to the contribution by Engineers Public Service of $4,000,000 to the capital account of Virginia Electric & Power.

All of the outstanding debentures of the Virginia Public Service Co., amounting to $10,500,000, and $1,500,000 of the company's bonds will be called for redemption, if the plan materializes.

It was pointed out by Mr. Barnes that the integration of the two concerns, serving contiguous areas in Virginia, would result in substantial operating economies, but warned that many problems were involved in completing the transaction that would take a great deal of time.

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Canadian, American Engineers to Cooperate

A program of joint meetings, collaboration of technical committees on special subjects and consideration of joint research projects were included in an agreement announced this week between the American Society of Mechanical Engineers and the Engineering Institute of Canada, in further promotion of the war effort.

The joint conference committee formed to work on future plans includes James W. Parker, A. G. Christie and Albert E. White of the American society and John B. Challies, John Hall and John E. Armstrong of the Canadian society.

Chemical Show Opens at Garden

More than 175 equipment manufacturers together with chemical companies and representatives of the government and the armed services opened the 19th Exposition of the Chemical Industries at Madison Square Garden in New York this week.

The exposition, born in World War I, as a vital necessity for the exchange of essential information and technical knowledge, had much in common with the original exhibit, although evidence of wartime restrictions was found in the slightly smaller size of this week's show to those in former years.

Increased manpower difficulties are threatening chemical production and the industry is experiencing great difficulty in securing draft deferments for trained employees, Dr. William T. Read, chief of the allocations section of the National Roster of Scientific and Specialist Personnel of the War Manpower Commission, told the press. The roster has some 80,000 chemists and about 20,000 chemical engineers on its registration rolls.

The Alien Property Custodian's Office has brought some 45,000 patents to the exposition and representatives disclosed that an abstract of 7,500 chemical patents held in the office will be available after the first of the year.

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Tacoma to Get New Power Unit

The War Production Board and the Production Urgency Committee have approved the purchase, by the city of Tacoma, of one complete 25,000-kw. generating unit and the imbedded parts of the second.

This was learned recently from Commissioner of Public Utilities R. D. O'Neil, who has been in the east pushing this proposition with government agencies.

The units will be installed in the new Adler powerhouse. This means that the city will produce for itself 175,000,000 kw.-hr. of energy instead of having to purchase a large quantity, as it is now doing.

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WPB Drops Rule on Fluorescent Fixtures

The requirement that all production of commercial type fluorescent lighting fixtures be specifically authorized by WPB was dropped December 1, allowing such production as long as it conforms to weight and other standards of Order L-78.

The move was to allow replacement of commercial fixture stocks which have almost been exhausted since manufacture of these fixtures was halted about 18 months ago. No additional materials were authorized for production of commercial fixtures, and any material so used will come out of the supply made available for all types for this quarter. It is anticipated that production will about equal the value of withdrawals from inventory during recent months.

It is expected that the production of commercial fixtures will increase measurably for some time, but industrial fixture production will continue to drop, as it has for some quarters, due to the slowdown of the construction program.

Meanwhile, WPB officials charged with the administration of Order L-78 are considering methods of preventing shops and stores from obtaining commercial fixtures in competition with war plants and other essential industries. It was suggested that the forthcoming version of L-78, expected by January 1, prohibit the purchase of commercial fixtures for maintenance, repair or operating purposes on a rating lower than AA-4. Since stores and such establishments have an AA-5 rating under CMP regulation 5, such an amendment would close the existing loophole. Essential users have an AA-1 or AA-2 rating under CMP Reg. 5, depending on whether they are listed on schedules I or II of the regulation.

While the need for industrial type fixtures is slackening, the need for commercial fixtures in offices and drawing rooms is increasing. It was emphasized that there is no intention of allowing the manufacture or sale of commercial fixtures for general commercial use.

MEETINGS

Previously Listed

Northwest Electric Light and Power Association—Accounting and business practice section, Heathman Hotel, Portland, Oregon, December 13-14. Berkeley Snow, executive secretary, 418 Spalding Bldg., Portland 4, Oregon.

American Society of Civil Engineers — Annual meeting Engineering Societies Building, New York, N. Y., January 19-21. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

Canadian Electrical Association — Annual winter conference of committees Mount Royal Hotel, Montreal, Que., January 20-21. B. C. Fairchild, managing director, 804 Tramways Bldg., Montreal, Que.

American Institute of Electrical Engineers — National technical meeting Engineering Societies Building, New York, N. Y., January 24-28. H. H. Henline, secretary, 33 West 39th Street, New York, N. Y.

Sales Executives' Conference — Netherland Plaza Hotel, Cincinnati, Ohio, February 3-4. H. E. Dexter, secretary-treasurer, 50 Market Street, Poughkeepsie, N. Y.

Output Up Again for 17.5% Increase

The output curve again reached a new high during the week ended December 4, after falling off sharply last week due to the Thanksgiving holiday intervention, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week totaled 4,560,158,000 kw.-hr., compared to 4,403,342,000 kw.-hr. the week previous. Figures for the latest week represent an increase of 17.5 percent over the 3,883,534,000 kw.-hr. distributed during the corresponding week in 1942.

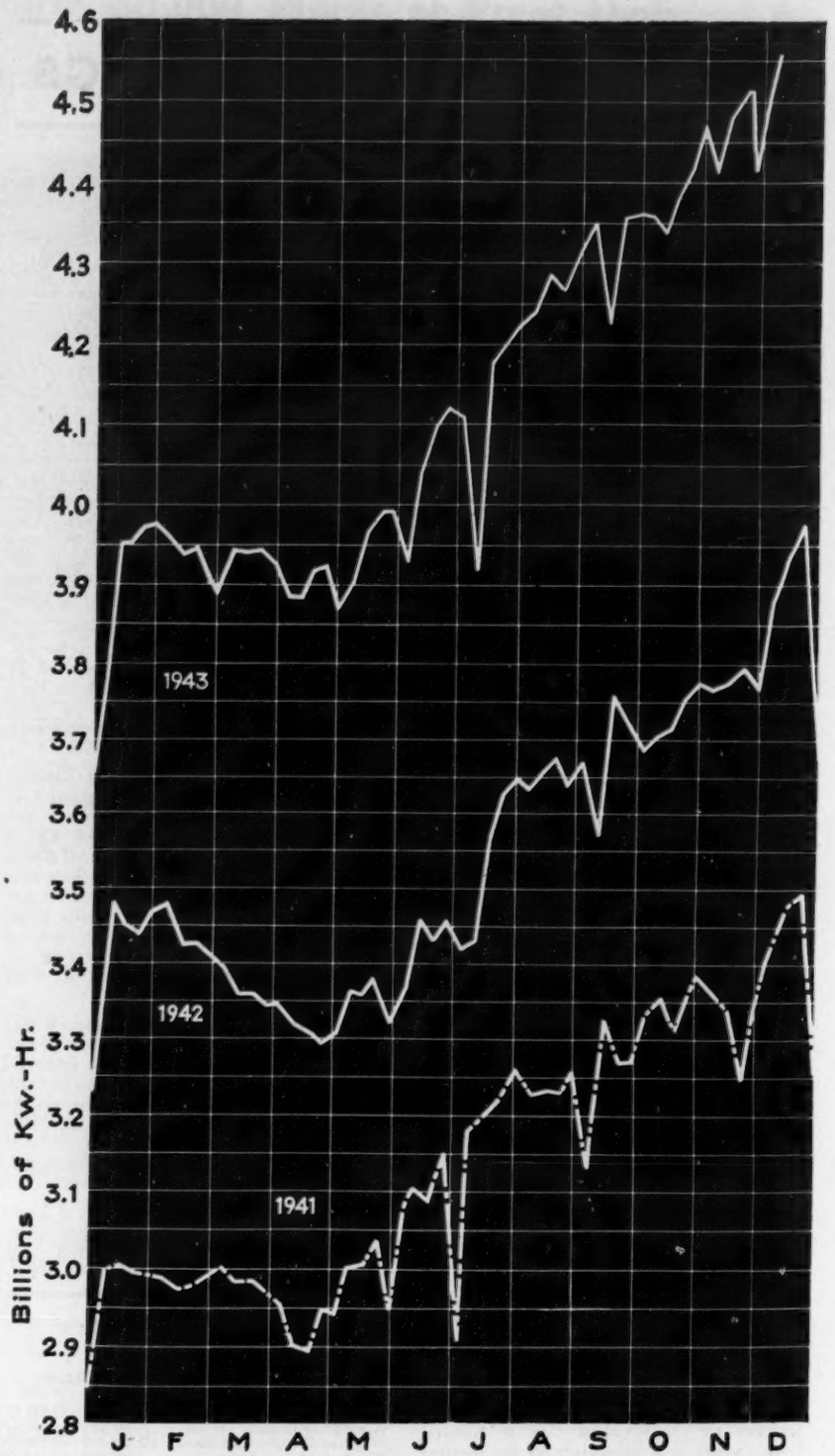
Four of the country's seven major geographic regions contributed to the rise during the latest week. The Pacific Coast region held first place again with a 35.3 percent increase over the 1942 week; the Southern States region, with a 17.9 percent gain, was in second place, and the mid-Atlantic region, with a 17.3 percent increase, was in third place. The New England region held an undisputed cellar position with only a 8.0 percent increase. The West Central region showed the greatest individual gain during the week as compared to the previous week.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Dec. 4	4,560	Dec. 5	3,883	Dec. 6	3,414
Nov. 27	4,403	Nov. 28	3,766	Nov. 29	3,339
Nov. 20	4,513	Nov. 21	3,795	Nov. 22	3,247
Nov. 13	4,482	Nov. 14	3,776	Nov. 15	3,348
Nov. 6	4,414	Nov. 7	3,762	Nov. 8	3,368
Oct. 30	4,452	Oct. 31	3,775	Nov. 1	3,380
Oct. 23	4,415	Oct. 24	3,752	Oct. 25	3,341
Oct. 16	4,382	Oct. 17	3,717	Oct. 18	3,313
Oct. 9	4,342	Oct. 10	3,702	Oct. 11	3,355
Oct. 2	4,359	Oct. 3	3,683	Oct. 4	3,330

Percent Change from Previous Year

	Week Ending		
	Dec. 4	Nov. 27	Nov. 20
New England	+ 8.0	+ 5.3	+ 7.7
Mid-Atlantic	+17.3	+18.1	+20.5
Central Industrial	+12.9	+11.5	+14.1
West Central	+10.4	+ 7.2	+ 7.9
Southern States	+17.9	+18.5	+19.9
Rocky Mountain	+14.4	+15.9	+15.5
Pacific Coast	+35.3	+34.6	+36.9
Total United States	+17.5	+16.9	+18.9



Public Service Co. Suit Alleges Illegal Ruling

Seeking a judicial ruling on the proposal of a rural electric membership co-operative to purchase an existing public utility, the Public Service Company of Indiana, Inc., has filed suit in Superior Court in Indianapolis against the Public Service Commission of Indiana, the Southeastern Indiana Rural Electric Membership Corporation and the Southern Indiana Light & Power Corp. of Vevay, Ind.

The state commission recently approved a petition by Southern Indiana and Southeastern for a sale by the former to the latter of all its lines and service facilities. Public Service Co. has opposed the petition on the ground that the state's rural electrification acts permit co-operatives only to enter territory not receiving electric service.

The Public Service Co., after alleging the ruling to be illegal, offers to purchase Southern Indiana as it is required to sell its holdings, improve the facilities and provide service at the regular rates. The company and the REMC are said to have almost identical rates.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders and opinions issued last week affecting electric utility companies:

APPROVED THE SALE by Durham Public Service Co., a subsidiary of Cities Service Power & Light Co., of all its fixed property and certain current assets to Duke Power Co., following which Durham will dissolve after paying off its refunding mortgage bonds, held by the public; its 6 percent cumulative preferred stock, also held by the public; distribution of its remaining assets to its parent, Cities Service, in exchange for all of its common stock held by them for retirement.

DENIED A REQUEST by Standard Gas & Electric Co. for recognition that provisions and restrictions on the class B common stock of Northern States Power Co. (Delaware) have been satisfied.

MODIFIED ITS RESTRICTIONS on common stock dividends of the Southwestern Public Service Co. to permit Southwestern to pay a 50-cent dividend except during the twelve-month period commencing last September 1, during which it may pay a dividend not in excess of $1 per share. The commission had imposed the limitation on September 14, 1942, as a condition to the company's issuance and sale of first mortgage and collateral trust bonds, serial notes and 6¼ percent cumulative preferred stock.

RECOMMENDED THAT THE Union Electric Co. of Missouri not be permitted to retain the St. Louis County Gas Co. in its holding company set-up. The action was based, in large part, on a survey purporting to show that electric and gas companies fare better alone than in combination with one another. Counsel for the North American Co., parent of Union Electric and grandparent of St. Louis County gas, argued that the survey underlying the utilities division's recommendation was faulty and that greater economies would obtain if St. Louis County Gas were allowed to remain a subsidiary of Union Electric.

APPROVED AN APPLICATION by the Columbia Gas and Electric Corp. to make a capital contribution of $114,000 to its subsidiary, Union Light, Heat and Power Co. At the same time, the SEC removed a restriction which prevented Union Light, Heat and Power to make interest payments on its 6 percent demand notes held by Columbia Gas.

PERMITTED TO BECOME EFFECTIVE a declaration of the General Gas & Electric Corp., which is a subsidiary of the trustees of Associated Gas and Electric Corp., proposing to pay out of capital or unearned surplus a quarterly dividend of $1.25 on its $5 prior preferred stock. The presently proposed dividend is applicable to the quarterly period ending December 15, 1942.

APPROVED Consolidated Electric & Gas Co.'s sale of the Raleigh (N. C.) Gas Co. to Charles B. Zeigler of Gastonia, N. C., for $217,870. All of Raleigh's outstanding securities ($63,000 of notes and $1,063,095 of common stock) are pledged by Consolidated to secure a note payable to Federated Utilities, Inc., which in turn secures Federated's 5½ percent lien collateral trust bonds due 1957.

APPROVED THE PROPOSED SALE of Highland Utilities Co.'s Mesa Verde (Col.) electric properties and Southern Arizona Public Service Co.'s electric, ice and water plant in Cochise County, Ariz. The step is preparatory to dissolution of the parent company, North Continent Utilities Corp.

Applications Filed

PROPOSAL OF OHIO Public Service Co. of Cleveland to approve its purchase of 330,000 shares of the Marion-Reserve Power Co.'s $5 par value common stock from Manufacturers' Trust Co. of New York. The price has been set at $2,550,000 if the purchase is completed before December 31. Between that date and May 1, 1944, the price would increase at the rate of $10,000 a month.

APPLICATION OF THE Ogden Corp. for approval of its plan to pay a dividend of 25 cents a share on its common stock on Dec. 29 to holders of record of Dec. 22. The directors approved the dividend, amounting to $850,000, to be paid from surplus.

PROPOSAL OF Cape & Vineyard Electric Co. to issue and sell to New England Gas & Electric Association 3,000 shares of common stock (of the par value of $25 a share) for the cash consideration of $50 a share, to aggregate $150,000. The proceeds from the issuance and sale of this stock are to be used for the purpose of paying Cape & Vineyard's indebtedness in the sum of $150,000, represented by its 3 percent interest bearing note payable to the First National Bank of Boston.

PROPOSAL OF THE American Water Works & Electric Co., Inc., to make a capital donation of $441,000 to improve the financial condition of its subsidiary, Commonwealth Water & Light Co. The donation would be accomplished by cancellation of an equal amount of open account indebtedness owed to American Water Works by the subsidiary.

PROPOSAL OF THE Electric Power & Light Corp. to make a capital contribution of 30,000 shares of $6 second preferred stock to its subsidiary, Louisiana Power & Light Co., to enable the latter to comply with an order of the Federal Power Commission. Louisiana also proposes a capital reclassification to simplify the corporate structure of both companies.

APPLICATION OF THE Jersey Central Power & Light Co. to make a gratuitous contribution to the capital of Ajincourt Land Corp., of which it owns all the outstanding shares except for three director's qualifying shares, of all indebtedness of Ajincourt to Jersey Central in the amount of $302,975 as of October 31, 1943.

Hearings Scheduled

DECEMBER 7: Postponed hearing, originally scheduled for this date, involving the application of Niagara Hudson Power Corp. and Buffalo, Niagara & Eastern Power Corp. for approval of a reorganization plan.

DECEMBER 14: Hearing of Consolidated Electric & Gas Co.'s proposal to sell its entire interest in Central Illinois Electric & Gas Co. to the public through underwriters, and, in connection with the sale asked for, an exemption from the competitive bidding rule of the commission.

DECEMBER 14: Hearing on a supplemental plan for the United Gas Improvement Co.'s disposal of substantially all of its holdings in Delaware Power & Light Co.

DECEMBER 16: Hearing the Commonwealth & Southern Corp. and a subsidiary, Ohio Edison Co., Akron, Ohio, request for approval for the retirement of treasury funds of $10,863,067 principal amount of Ohio's outstanding $6.60, $7 and $7.20 series of preferred stock.

DECEMBER 23: Hearing on the Federal Light & Traction Co.'s proposal to sell all of the outstanding capital stock, namely, 2,500 shares of $100 par value each of Rawlins Electric Co., an electric utility subsidiary operating in Rawlins, Wyo., to Edmund Steinauer of Lincoln, Neb., for a consideration of $350,000.

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Utility Reports

	Net Income 1943	1942
*Alabama Power	$5,128,989	$3,337,571
†California-Oregon Power	1,300,835	1,118,319
†Central Illinois Pub. Serv.	2,224,859	2,178,040
*Central Maine Power	3,362,525	3,354,124
†Central Power & Light	1,580,640	1,420,236
*Commonwealth & Southern and subs.	13,448,081	9,889,784
*Consumers Power	7,856,234	8,043,019
†Duquesne Light	10,773,060	10,820,606
*Georgia Power	6,384,593	5,440,617
†North American and subs.	18,864,522	19,308,862
†Northwestern Public Serv.	416,929	361,816
*Ohio Edison	3,497,833	3,060,842
*Public Service (N.H.)	1,354,171	1,438,906
†Southwestern Gas & Elec.	1,412,524	1,576,389
†Virginia Public Service and subs.	949,128	729,731
†West Penn Elec. and subs.	5,034,094	5,152,394

*Twelve months ended October 31.
†Twelve months ended September 30.

FPC Issues License for Holtwood Project

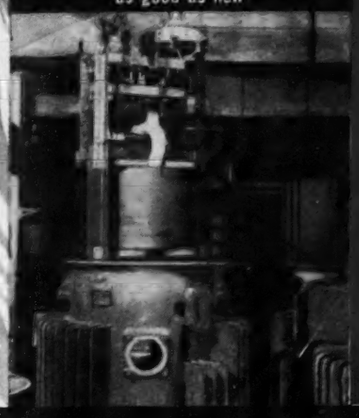
Federal Power Commission has authorized the issuance of a federal license for a period terminating in 1970 to the Pennsylvania Water & Power Co., with main offices in Baltimore, Md., for the 111,000-kw. Holtwood hydro-electric development on the Susquehanna River in Lancaster and York counties, Pennsylvania.

The project consists principally of a concrete gravity overflow dam about 2,392 feet long and 55 feet high, a pool extending upstream about 8 miles and a power house containing ten main units having an aggregate capacity of 111,000 kw. In addition, the applicant also maintains a steam plant, loading docks and other facilities which occupy lands within the project boundaries and areas which the applicant has designated as "common property." Construction of the project was begun in 1905, the first unit was placed in operation in 1910 and the last in 1924.

3 Pictures Worth 30,000 Words of Proof That:

"Pyranol transformers cannot burn or contribute to a fire"

Core and coils were found as good as new



They stood up under fire

They came through a $50,000 fire virtually unharmed. Although surrounded by flame, they did not add to the fire.

Several bushings had to be replaced, and tanks repainted — that was all

ONE of the many benefits to be obtained from the installation of Pyranol* transformers was amply demonstrated recently when 12 Pyranol units were subjected to a severe external fire at a new war plant in the South.

From the field engineer's description of the fire, it is obvious that transformers without non-inflammable liquid, subjected to the same conditions, would have been almost a total loss. And it has been estimated that, with some types of transformers, the damage to the plant might have run as high as half a million dollars.

*Reg. U. S. Pat. Off.

The only reconditioning found necessary was the replacement of several bushing porcelains which were cracked by the heat, the painting of the tanks, and the addition of a small amount of new Pyranol to make up for that lost through the bushings.

The transformer interiors were in perfect condition. It was not even necessary to filter the Pyranol.

Here's an experience that proved the wisdom of investing in Pyranol transformers, from the standpoint of safety and reduction of losses from fire. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

402-63-5100

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Series Capacitor Drops Welder Demand

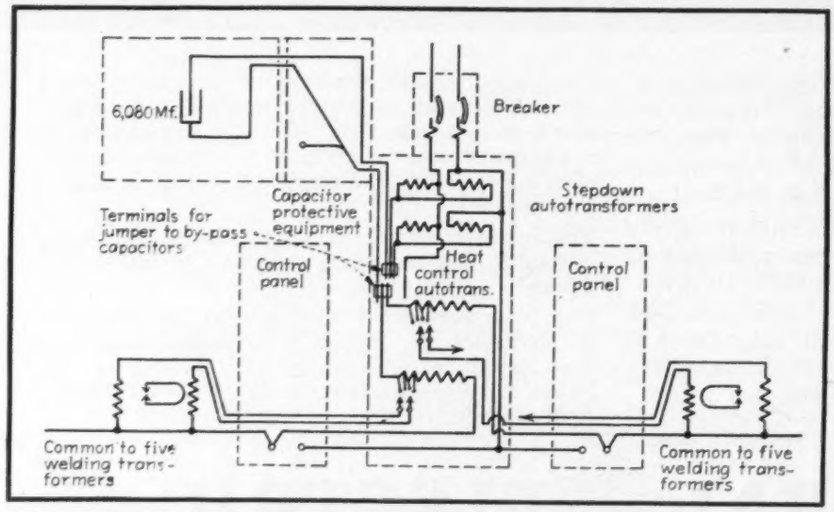
By B. L. McARDLE
Electrical Engineer United Steel & Wire Company, Battle Creek, Mich.*

Six automatic resistance welders are used in the plant of the United Steel & Wire Company at Battle Creek in production of landing mats for airplane fields. Installation of a series capacitor on one of these machines demonstrated the value of the capacitor in putting more heat into the weld and in improving welder performance in respect to energy supply. Success with the first machine was followed by application of capacitors to the others.

Without the capacitor, the machine had a during-weld demand of 1,050 amp. with 480 volts at the welding transformer primary. Energy input, measure of heat to the weld, was 237 kw., and the power factor thus was 47 percent. Installation of the capacitor resulted in a drop in the ampere demand to 640, in a rise of power factor to unity, in a 300-kw. input representing welding heat and in a rise of welder transformer primary voltage to 550. The reduction in line demand is caused by power-factor correction and the increase in welder transformer voltage comes from the potential rise contributed by the capacitor. The greater energy input to the weld reduced welding time and increased production.

Welder supply is at 500 volts. Because of voltage rise from series resonance it was necessary to provide a means to counteract it. This was done by including an auto-transformer in the circuit, as shown in the accompanying diagram, so as to reduce the voltage ahead of the capacitors. In this way voltage beyond the capacitors will be within range of the welder supply potential, allowing the use of standard welding transformers.

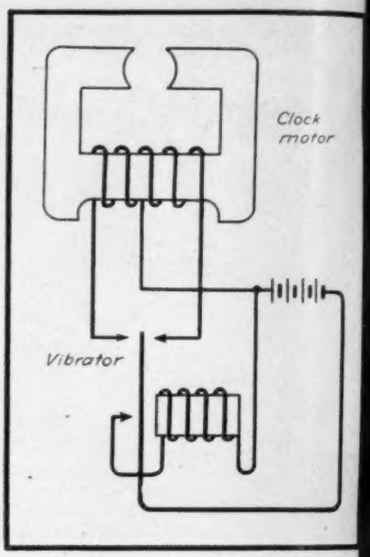
*Now in U. S. Army.



SERIES CAPACITOR has stepdown auto-transformer buffer in welder connection; each welding transformer primary has one end fed from an auto-transformer tap selector switch, allowing for individual heat control

Battery-Operated Synchronous Clock

Developed in the shop of the Alabama Power Company as the chan drive for an instrument to record operations of motor buses is a bat



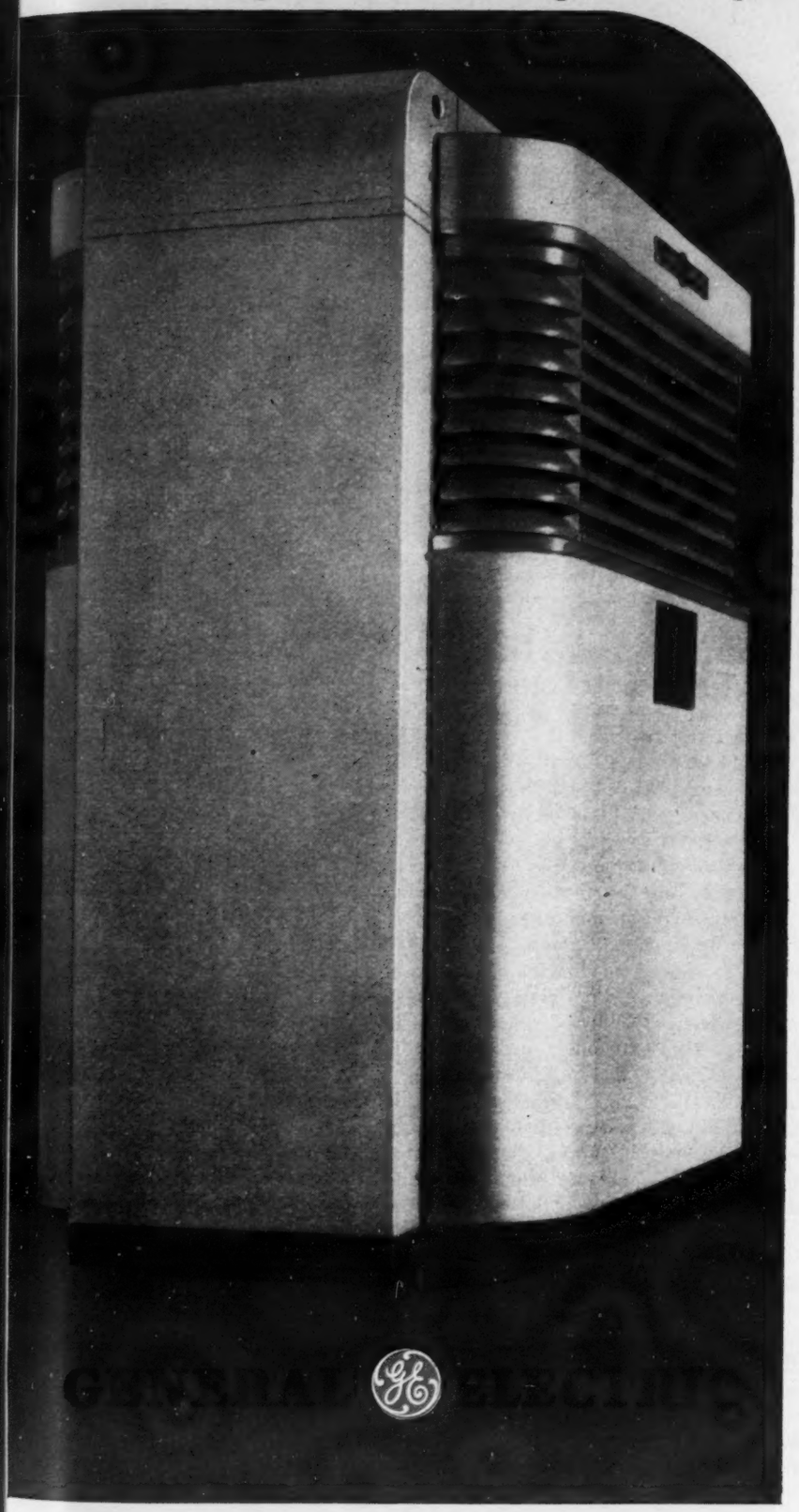
SYNCHRONOUS CLOCK adapted for operation on battery

tery-operated synchronous clock mo tor that could find usefulness in elec tric system operation.

A self-starting synchronous clock motor is rewound for 12 volts or any other desired battery voltage. The winding has a center tap. It is con nected to the battery through an auto mobile radio vibrator, as shown in the sketch. Although these vibrators are not calibrated to super-exact fre quency, they are produced in quan tity to fixed dimensions and investiga tion showed that they are quite accurately on the nose of 120 cycles per second and will run the clock

REDESIGNED

For greater safety, for speedier installation



THE DRY-TYPE TRANSFORMER of the FUTURE is available NOW

THIS ultramodern distribution transformer is not just a postwar gleam in a designer's eye. *It's an actuality.*

Such transformers are now available for use on 601- to 15,000-volt primary circuits, in ratings from 100 to 500 kva.* We offer them at this time because they afford greater safety and speedier installation than previous dry-type designs—both vitally important today.

For 50 years General Electric has built dry-type transformers. But in designing these streamlined units, we threw tradition to the winds. For indoor installations in industrial plants, their metal-enclosed construction offers a greater degree of safety than the former, open-screened design. Also, the unique housing provides the advantages of enclosed terminals, so arranged as to permit speedy installation.

There are undoubtedly many questions that you'd like to ask about their construction features—features that make for ready accessibility of all parts, excellent ventilation, ease of installation, and safety. You'll find all these questions answered in our new bulletin. Ask for a copy. *General Electric Co., Schenectady, N. Y.*

**G-E dry-type transformers are also available in certain sizes larger than 500 kva.*

Bulletin GEA-37148

DRY-TYPE TRANSFORMERS

402-64-5100

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

motor at double speed. For short periods of a few hours or even of a day or so the time error is negligible.

In an unattended substation, for instance, such a clock might be used to record times and durations of service outages or to initiate desired switching or other operations after longer lapses of time than are possible with ordinary relay settings.

•

Boosters on Overloaded Street-Lighting Circuit

By L. M. VanMETER
Pacific Gas & Electric Company
Oakland, Calif.

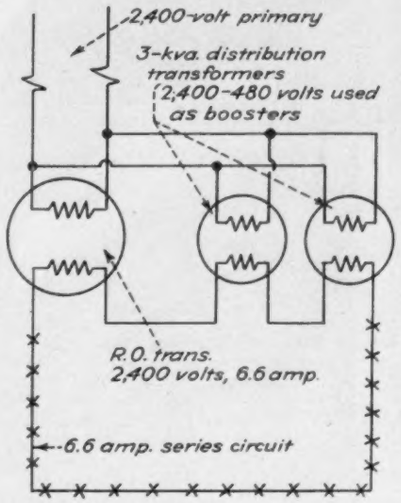
Satisfactory service, in spite of restrictions and limitations on equipment, taxes the ingenuity of the distribution engineer. Recently the Pacific Gas & Electric Company had one of its street-lighting circuits in the Bay area badly overloaded due to the rapid expansion of war industries, which resulted in very poor lighting. An estimate was prepared on the basis of dividing the circuit and installing an additional RO constant-current transformer and Novalux controller. However, as the cost of this change was over the $500 limitation, the job was canceled and it became necessary to find some other means of increasing the current in the series circuit without exceeding this cost.

Impress 960 Volts

The circuit was supplied by a 15-kw., 2,400-volt, 6.6-amp. type RO constant-current transformer. It was decided to install two standard distribution transformers as boosters, each rated 3 kva., 2,400 to 480 volts (actually 5-kva. units were used because of available stocks). The high-voltage windings were connected in parallel across the 2,400-volt primary and the secondaries connected in series on the 6.6-amp. series street-lighting circuit, as shown by the accompanying diagram.

The result was that 960 volts was impressed on the series circuit in addition to the voltage supplied by the constant-current transformer. With this help from the boosters, the current rose from a value considerably below 6.6 amp. to approximately 6.6, thus accomplishing the desired result.

The boosting action might also be thought of in terms of power, which, in this case, amounted to $\frac{960 \times 6.6}{1,000} = 6.336$ kw. It will be noted that unless a rather high booster voltage is used there will be little boosting action, due to the current being limited to 6.6 amp. It was for this reason that transformers with 480-volt secondaries were used. It is evident that the maximum output which can be obtained from a 480-volt transformer, regardless of size, is 480 x 6.6/1,000 = 3.168 kw.


2,400-volt primary
3-kva. distribution transformers (2,400-480 volts used as boosters
R.O. trans. 2,400 volts, 6.6 amp.
6.6 amp. series circuit

TWO distribution transformers serve as series boosters for overloaded street-lighting circuit

Cost of the boosters was approximately one-fourth that of the constant-current transformer and controller originally proposed.

It should be understood that this application, while giving additional capacity at low cost and serving as an expedient under present conditions, has several objections:

1. If a portion of the series circuit should be lost so that the voltage necessary to supply the remainder were less than that supplied by the boosters, then all of the lamps on the remainder of the circuit would be burned out. In other words, the full voltage supplied by the boosters would remain on the circuit regardless of the regulating action of the constant-current transformer.

2. The voltages on the secondaries of all transformers involved would exceed rated values and there would be a possibility of the insulation on the secondary coils breaking down.

3. There might be a safety hazard due to workmen forgetting about the booster voltage, particularly if the boosters were located on a separate pole from the main transformer. However, this hazard could be eliminated to a large extent by installing a warning sign on the main transformer pole.

•

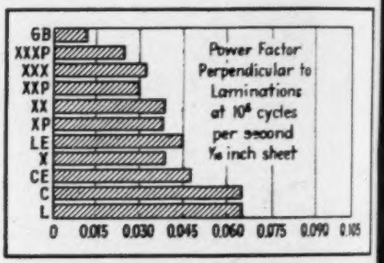
How to Test Insulating Materials*

1. Power Factor Tests

By J. R. FREED
Continental-Diamond Fibre Co.
Newark, Del.

A foremost test for evaluation of electrical insulating materials is that for power factor. That specific electrical property is defined, according to the A.S.T.M. Standard Method (D-150), as a measure of the energy loss in an alternating electrical field. Power factor may also be defined as the ratio of the total power loss (in watts) in an insulating material to the product of voltage and current in a capacitor in which that material is a dielectric.

Power factor may be considered an indication of the stability of the insulating material in question or a check of the uniformity of specimens. In some cases it is desirable to have low power factor, while in others it is not so important; in all cases, however, it is a useful means to indicate purity of composition and useful life under electrical stresses, as well as the efficiency of the insulator.



TYPICAL power factors for various grades of laminated phenolic insulations

Insulating materials are usually tested at 60, 10^3 and 10^6 cycles per second. Measurements are made based on the "thickness" dimension and in the case of laminated materials pri-

*First in a series of nine articles.

LARGE BANKS OF CAPACITORS PROVIDE A QUICK, LOW-COST WAY OF RELEASING SYSTEM CAPACITY

QUICK: The *availability* of Pyranol capacitors as a source of reactive kva makes their use the quickest method of releasing system capacity for heavy war loads —especially now when materials, and labor to manufacture equipment, are at a premium.

LOW COST: Pyranol capacitors can be put on a system at a cost of well under $10 per kva. The relatively high-cost system facilities can then deliver more kilowatts. This is of vital importance in the wartime drive to obtain maximum kilowatts from present facilities. Savings in critical materials, and ease of installation and switching to meet variable load demands, are also important considerations.

INSTALL THEM IN LARGE BANKS NEAR THE LOAD: Banks of G-E Pyranol capacitors are available as large outdoor and indoor rack-type equipments. Many utilities have found it advantageous to build their own outdoor racks of wood and standard-line hardware, so that they can use these capacitors in smaller groups on distribution circuits when the emergency need for larger banks is past.

Ask your G-E representative for his suggestions on the application of capacitors in large banks. He'll be glad to help you with such problems as fusing, relay protection, and switching. Or write for Catalog GEA-2764B. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

407-46-5704

marily with tests conducted perpendicular to laminations. Measurements parallel to laminations are also made and are included in this discussion.

A sheet material specimen has dimensions usually 6x6 in. or 6 in. in diameter and is partially or wholly covered on both sides with lead foil electrodes of suitable size to give a capacitance of preferably not less than 100 micromicrofarads. Petrolatum of a highly refined type is used as an adhesive. The prepared sample forms a capacitor of unknown capacitance and is connected in parallel with a precision condenser.

Tubes are prepared for power factor tests by being coated on the inside and outside with lead foil electrodes of sufficient length to provide a capacitance of preferably not less than 100 micromicrofarads. Sometimes mercury is used as the inside electrode.

One of the standard test methods for power factor is called the "Resonant Circuit; Resistance Variation Method." Measurements are at 10^6 cycles per second. Equipment consists of a stable high-frequency generator, a vacuum tube voltmeter, decade resistors and a standard precision type variable air condenser.

Test Procedure

The test is run by adjustment of the precision condenser with the sample in the circuit until resonance is obtained. Then with the sample out of the circuit, the precision condenser is again adjusted to resonance; by means of the decade resistor this second resonance value is brought to the same meter deflection value as noted for the initial resonance. From the instrument readings the capacitance is calculated. Then power factor in percent is determined by substituting in the formula:

$$\text{Power factor} = 2\pi RCf \times 10^{-9}$$

where R is resistance in ohms, C is capacitance in micromicrofarads and f is frequency in kilocycles.

Insulating material is also frequently tested at 60 cycles per second. This test is performed on a suitable capacitance bridge in which direct readings of capacitance in microfarads and power factor in percent are obtained. In that type of bridge an electron ray tube is used as a null indicator. An additional procedure covers power factor measurements at a frequency of 1,000 cycles per second and is conducted on a capacitance bridge which employs an acoustical indicator to obtain a balance. The power supply to the bridge consists of a 1,000-cycle tuning fork.

Many sources of error may enter into the test, such as stray field, both electrostatic and magnetic, and poor contact of electrodes. The foil electrodes must make intimate contact with the specimen for even minute air bubbles cause large errors in results. This property of insulating materials is affected by temperature, frequency, and atmospheric humidity. When specified, the insulating material is conditioned before testing; the Standard A.S.T.M. conditioning procedure for the phenolic laminated type of material is 48 hours drying at 50 deg., plus or minus 3 deg. C. (D-618).

Parallel to Laminations

It is a recognized fact that power factor of laminated insulation measured parallel to laminations is not the same as that perpendicular to laminations. The method of test (ASTM D-669) calls for the use of the same apparatus as for the perpendicular test, but the test specimens are different. Specimens are cut 0.250 in. in width by 5.25 in. in length in sufficient quantity to make a pile-up of approximately 5.25 in. in height; they are mounted in a square metal frame and clamped tightly. Lead foil electrodes 2 to 4 in. in diameter are applied to both sides of the specimens and the test performed at the desired frequency by the Resonant Circuit; Resistance Variation Method.

Adaptations of D.C. Voltmeters

By PAUL MacGAHAN
Meter Engineer, Westinghouse Electric & Manufacturing Co., Newark, N. J.

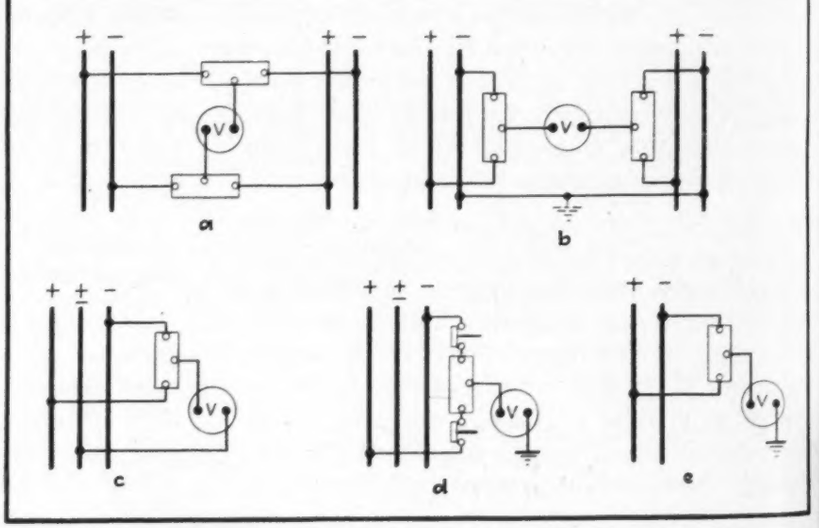
Conventional type of permanent magnet d.c. voltmeters which have one moving coil and two control springs can readily be applied as differential and as ground-detector voltmeters instead of using the more complicated two-coil or divided-coil construction which requires three conducting springs.

Instead of the voltmeter resistance being self-contained, a mid-tap external resistor is used for each circuit as shown in the illustrations. An internal resistance is also retained within the voltmeter for calibration purposes.

As the voltmeters are adjusted and calibrated with the zero in the mid-scale position, the current required for full-scale deflection is half the usual value for the type of voltmeter having a left-hand zero scale. Therefore, the ohms required for any full-scale rating are doubled.

In illustrations (a), (b) and (c) the voltmeters indicate the potential difference between two circuits, the pointer direction indicating toward the circuit having the higher value.

In illustrations (d) and (e) the voltmeter pointers are arranged to indicate away from the terminal, which is on the grounded side, and to indicate the potential difference from the terminals to ground.



EXTERNAL WIRING DIAGRAM—Differential voltmeter for (a) two independent circuits, (b) paralleling two circuits, (c) Edison three-wire circuits; ground detector for (d) Edison three-wire circuit, (e) two-wire circuit

For All Types of Wiring

FLAMENOL*

Small Diameter

BUILDING WIRE

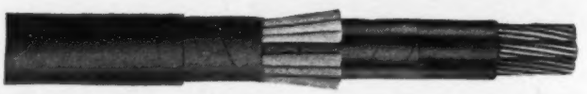
Flamenol thermo-plastic insulated small-diameter wire, Type SN, is available in sizes 14 to 1,000,000 CM. (Resins are now permitted for electrical conductor insulation wherever copper is allocated.) Its small diameter, comparatively light weight and smooth finish make it easy to handle. It will give long dependable service.

Flamenol Building Wire was developed before the war. It has been used for a number of years in all sorts of buildings. *It is ideal for maintenance work, for rewiring or for new wiring.* It is approved by the Underwriters'. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to oils, moisture, acids, etc.

FOR FURTHER INFORMATION on Flamenol Building Wires, Loom Bus-drop Cable, Conduits or Wiring Devices see the nearest G-E Merchandise Distributor or write to Section CDW-1235-9, Appliance and Merchandise Department, General Electric Co., Bridgeport 2, Conn.

*Reg. U.S. Pat. Off.

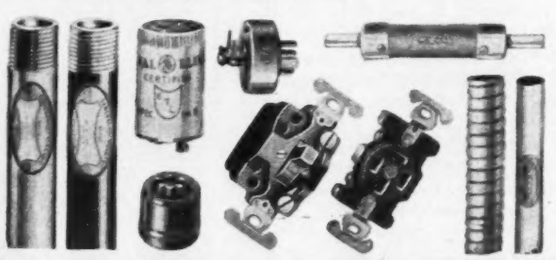
LEADED CABLE - TYPE RL



G-E single- and multi-conductor lead sheathed cables are available in sizes 14 to 2,000,000 CM. These sturdy cables are insulated in accordance with WPB limitations and are sheathed with commercially pure lead formed tightly around the core. Special precautions are taken to control the thickness of the lead and to center the cable in the sheath.

G-E CONDUITS AND WIRING DEVICES

General Electric also offers for war wiring needs: G-E White hot-dipped galvanized conduit and G-E Black enamelled conduit, EMT, flexible metal conduit and hundreds of switches, lampholders, outlets, fuses, etc.



GENERAL ELECTRIC

WARTIME TRANSFORMER STRUCTURES CONSERVE CRITICAL MATERIAL

Two departures from a basic pre-war, two-pole power transformer bank structure (Fig. 1) using steel as principal load-carrying members have been used during the war period by the Oklahoma Gas & Electric Company, to conserve critical steel and copper.

More common of the two wartime designs is a three-pole arrangement (Fig. 2) with each transformer of the bank on a separate pole with open-wire primaries and secondaries. The other, used only where space limitations will not allow the three-pole arrangement to be installed, provides for mounting two transformers on one pole and one on the other of a two-pole structure in the manner shown in Fig. 3.

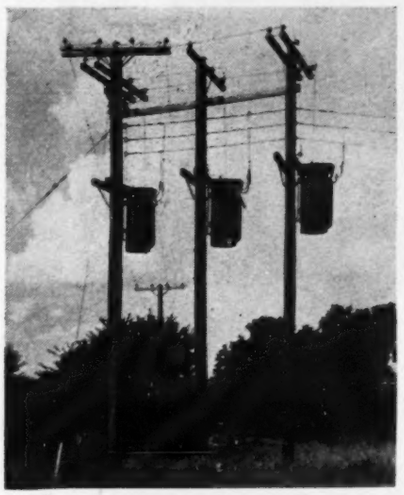


FIG. 2—Structural steel has been eliminated by mounting transformers on individual poles

Comparison of the amounts of copper and steel required for the three types of structures based on a 100-kva. maximum transformer size follows:

Type Structure	Copper, Lb.	Steel, Lb.
Pre-war two-pole .	175	820
Special three-pole.	185	265
Special two-pole...	150	230

Major economies in material over the pre-war design have been made in steel by eliminating the two main structural beams and connecting vertical members from which the transformers are supported and reverting to a crossarm mounting of the type commonly used for single-phase distribution transformers. Additional savings in steel have been made by eliminating the conduit inclosure for primaries, used in the pre-war design, in favor of open-wire primary and secondary buses in the more recent designs.

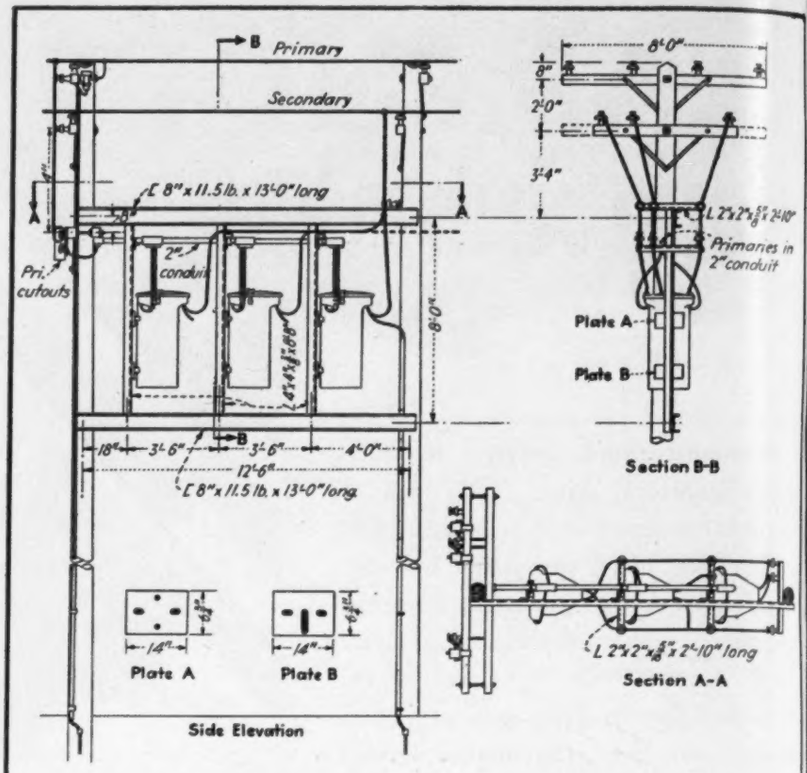


FIG. 1—Basic pre-war transformer bank structure uses steel beams, columns and conduit-inclosed primaries

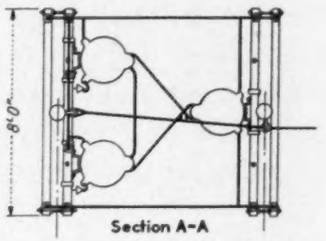
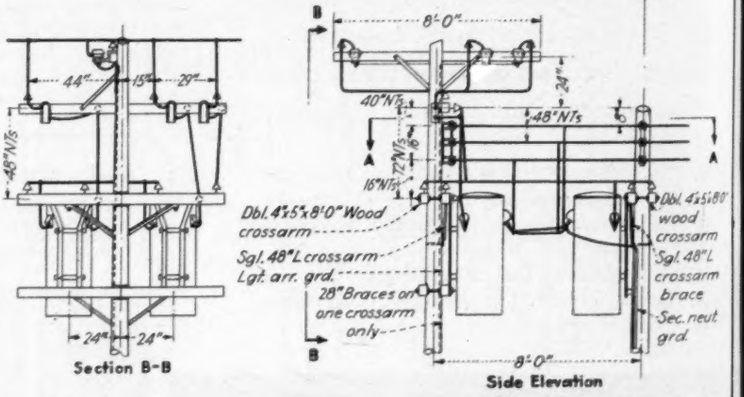


FIG. 3—Where space is limited two transformers are mounted on one pole and the third transformer on another pole



HIGHER VOLTAGE AND BETTER REGULATION

Cut COPPER CONSUMPTION

One way to curb waste and help to remedy the serious shortage of copper and insulating materials is to operate insulated wires and cables at the highest voltage consistent with safety. Every effort should also be made to increase operating efficiency by more effective voltage regulation.

Higher voltage and better regulation on systems now in operation will mean more efficient use of the copper now in service. Most distribution systems were designed with a margin of safety that may justify higher operating voltage for the duration of the war.

A change to higher voltage should be considered wherever replacement or rewiring becomes necessary. If it can be done it will mean a definite saving in copper and may result in more efficient and economical operation.

Plans for new distribution or expansion should be postponed until after the war. If they cannot be postponed, provision should be made for the highest practicable voltages—both primary and secondary.

The cables you already have should be used to the utmost limit of their usefulness. The design and manufacture of new cables are restricted by War Production Board regulations but if you must buy new ones for vitally essential war work we shall be glad to tell you what Simplex insulated wires and cables can do for you.

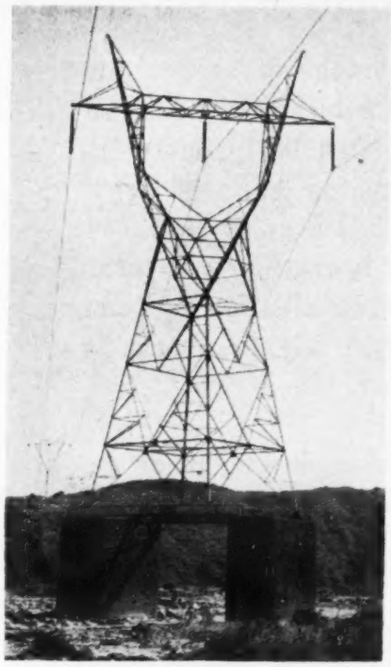
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex
WIRES and CABLES

Sturdy Foundation for Transmission Tower

By CLAYTON M. ALLEN
Bureau of Power & Light,
Los Angeles, Calif.

Occasional winter rains often transform stream beds of the Pacific Southwest, normally dry, into rivers of flood proportions, requiring transmission line crossing structures lo-



BOAT-TAIL tower foundation extending 20 ft. below and 28 ft. above dry riverbed withstands record floods

cated in or near such "washes" to be of special design. Such a structure was necessary in carrying the 287,000-volt Boulder transmission line third circuit of the Los Angeles Bureau of Power and Light over a wash near Los Angeles to prevent possible outages due to flash floods in this area.

Extending 20 ft. below and 28 ft. above the stream bed, two hollow streamlined concrete piers of "boat-tail" design were placed in the wash paralleling the direction of flow. On the tops of the piers a galvanized structural steel bridge supports the 100-ft. standard suspension tower, which in turn carries the three 1.4-in. diameter type HH segmental conductors of the transmission line across the wash at an angle of 60 deg. with its centerline.

The hollow piers were constructed of transit-mixed concrete proportioned 1-2½-3½, which, after curing with a black sealing compound, were backfilled, using excavated material.

Performance over four years since installation, during one of which it was subjected to a record runoff, has proved the wisdom of the streamlined and sturdy construction of this tower foundation.

•

Uses Single Crossarm for Dead-ends

Practice of dead-ending line conductors up to No. 4 copper on a single 4x5-in. (nominal) crossarm, with its 5-in. dimension horizontal, has been used as a material conservation practice for a little more than a year by the Empire District Electric Company, Joplin, Mo.

Several hundred single-arm dead-ends of this type have been installed on the system in place of the more conventional double-arm construction using 3¼ x 4¼-in. arms. Each such installation is estimated to save the following construction materials: One crossarm, two steel crossarm braces, two carriage bolts, one lag screw, six square washers, seven nuts and about 22 in. of bolt length.

•

Change Coal Piping to Stop Clogging

The accompanying "before" and "after" views show how a bad constriction in the coal inlet to a pulverizing mill at Ohio River station of Southern Indiana Gas & Electric Company was eliminated by a change in the piping arrangement. The constriction was caused by a 12-in. pipe being reduced to 10 in. at the mill inlet. With wet coal, this constriction caused the coal pipes to plug up frequently. It was very difficult to clean them out.

The "after" view shows the change from a round inlet pipe to a much larger rectangular section with a greater slope at the mill inlet. This type of inlet does not plug up as easily with wet coal and is much easier to clean. Note that two small poke-holes have been provided. The new inlet has also been provided with renewable wearing plates which have been bolted in place for ease in replacement.

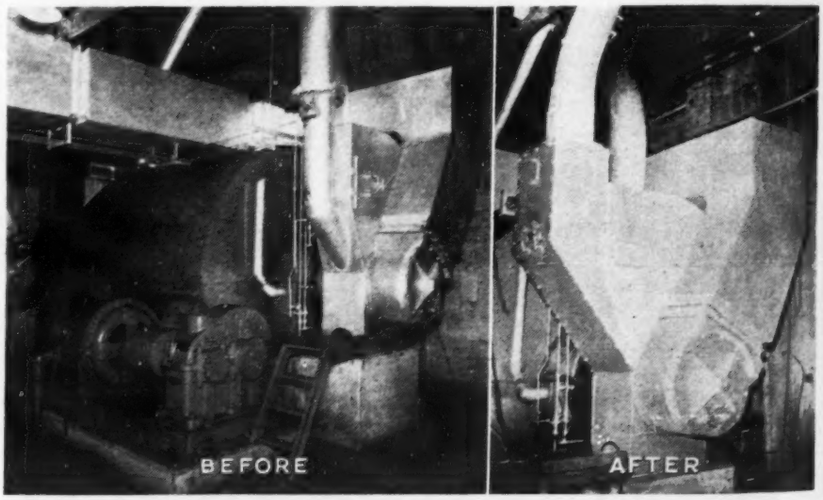
•

Valves Installed on "Live" Transformers

By B. O. CHANEY
Division Engineer, Tennessee Valley Authority

For installation of radiator valves on the tanks of two 10,000-kva., three-phase, 110/13.2-kv., water-cooled transformers a tank cutting tool was developed and used by the author and associates. Installation of the valves was necessary prior to the connection of radiators of the forced-oil circulation, fan-cooled type to alleviate overheating of the transformers.

Ordinarily oil removal would be necessary, in this instance more than 9,000 gal. The transformers were



TENDENCY of wet coal to clog up at constriction in coal mill inlet pipe (see "before") is eliminated by change to larger inlet section shown in picture at right

IN A PHILCO FLOTÉ STORAGE BATTERY, YOU MAINTAIN THE CHARGE WITH

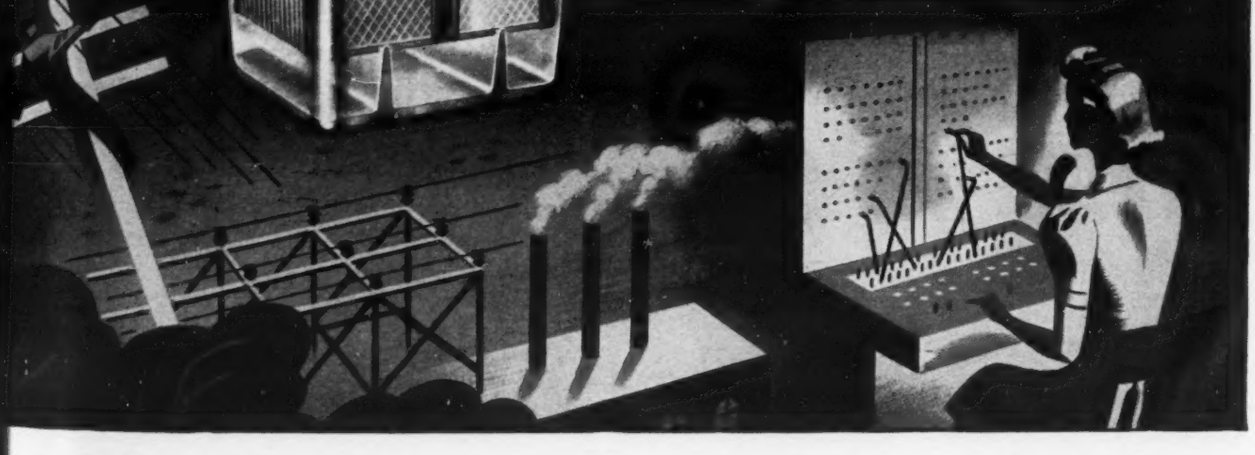
40% LESS CURRENT!

Philco Floté is the only battery specifically designed for modern full float service! The special metal in which Floté grids are cast reduces the amount of current necessary to maintain the charge by 40%! This low current consumption materially increases the life of the cell! Floté grid design, too, retards peroxidation and provides exceptional strength and superior electrical efficiency. Philco Floté supported element cells are available for all types of telephone, control and stand-by service in capacities ranging from 10 A.H. to 1680 A.H. Write for complete information and specifications. *Philco Corporation, Storage Battery Division, Trenton 7, New Jersey.*

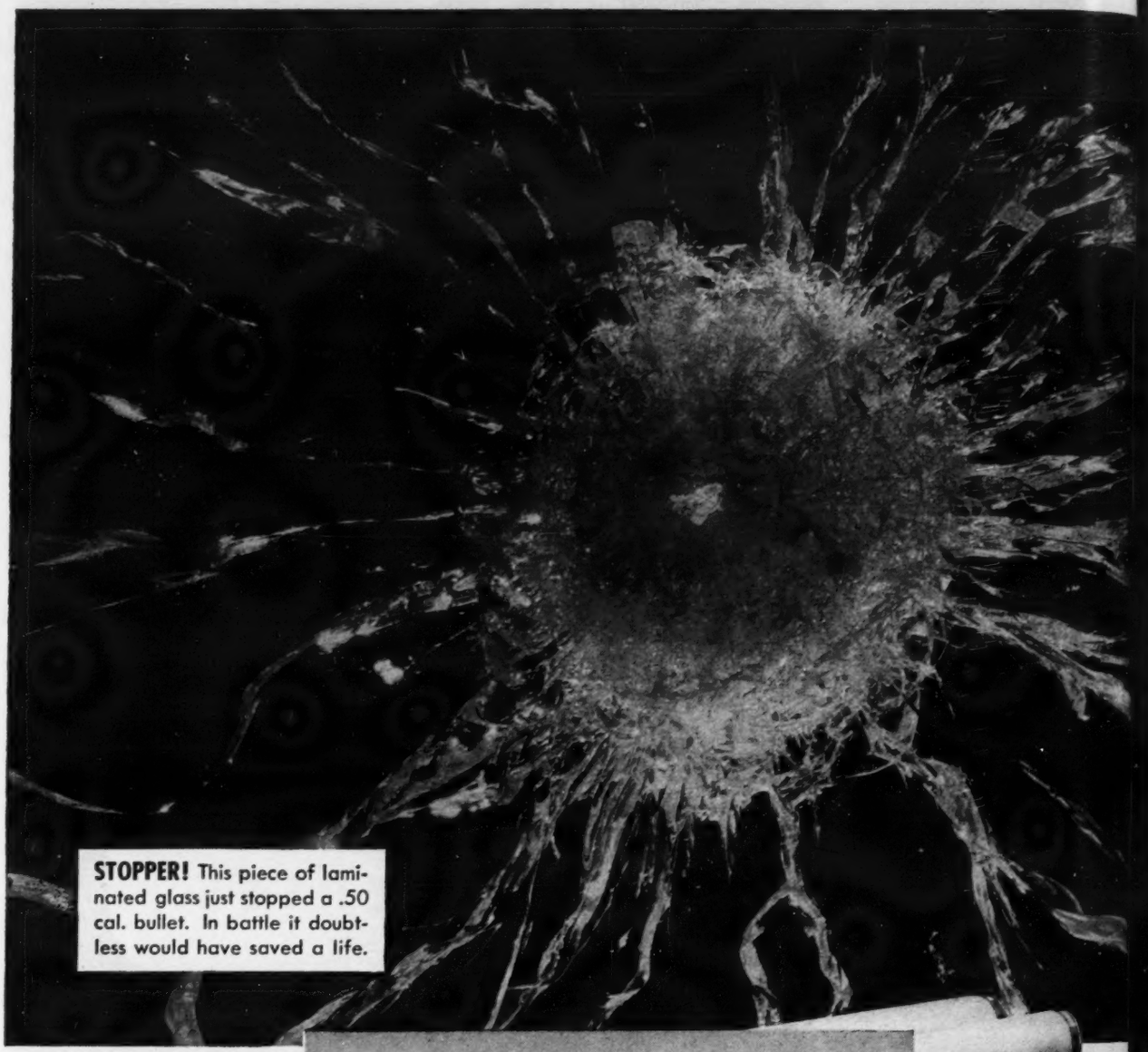
Replace with

PHILCO STORAGE BATTERIES

Philco Battery Cell Type 23FFP



Greater security for men



STOPPER! This piece of laminated glass just stopped a .50 cal. bullet. In battle it doubtless would have saved a life.

Westinghouse

MAZDA LAMPS

FOR BETTER "SEE-ABILITY"

en who man the flying guns

They deserve the best, and they're getting it, these brave young lads who fight it out, high in the sky. Today, in plants equipped for perfect *"See-ability,"* Industry is building amazing new gun turrets for them!

ilot to Crew: "Fighters at 10 o'clock . . . *coming in fast!*"

nd now the show is really on!

ut, don't worry—our boys can take care of themselves. etter training, better guns, better planes and equipnent—all have lengthened the odds in their favor.

Take those gleaming gun turrets, for example. They're nade of plastic, polished and repolished until it's lear and eye-true as air.

nd in many bombers, there are shrewdly positioned nserts of bullet-resisting glass, tough enough to stop .50 cal. bullet or deflect an aircraft cannon shell!

t's mighty important work—building these turrets. And throughout every step, from shaping the plastic to final inspection, "See-ability," through better, more scientific lighting, is helping men and women combine care and accuracy with speed and—still more speed.

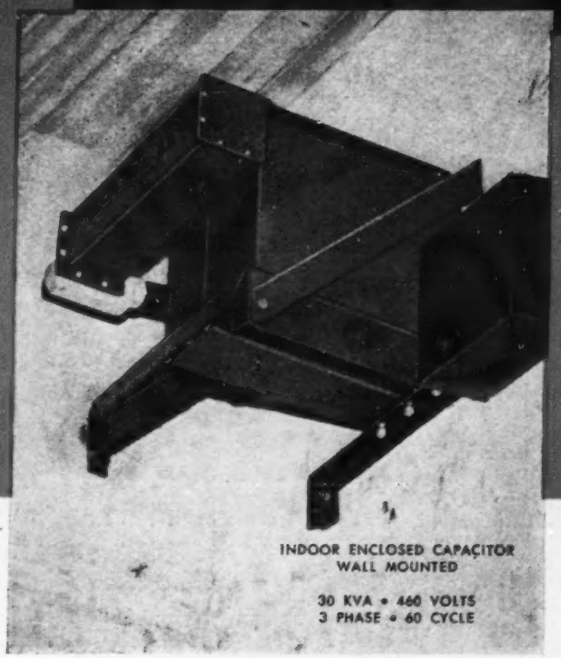
Today Westinghouse Mazda Lamps are bringing better "See-ability" to countless industries. In every field they are helping set amazing new lighting standards for the world of tomorrow!

Recommend them to your customers. Constantly improved, Westinghouse Mazda Lamps are brighter, longer-lasting, lower in cost than ever before! Westinghouse Electric & Manufacturing Company, Lamp Division, Bloomfield, N. J. *Plants in 25 cities... offices everywhere.*

KEEP YOUR DOLLARS FIGHTING . . . BUY WAR BONDS

Questions and Answers ON THE SUBJECT OF

C-D CAPACITORS



INDOOR ENCLOSED CAPACITOR
WALL MOUNTED

30 KVA • 460 VOLTS
3 PHASE • 60 CYCLE

FOR POWER-FACTOR IMPROVEMENT

Last month we printed a few commonly-asked questions on Capacitors for power-factor improvement, together with their answers, in one of our advertisements. The response to this advertisement has been extremely gratifying. Readers have written us, saying that this is the type of informative advertising they like to see. And many of them have submitted questions that have arisen in trying to solve their own power-factor problems. A few of these questions follow:

Question: *What is capacitor stress?*

Answer: Capacitor stress is the ability of capacitors to stand up under severe overload conditions. C-D capacitors have a high stress factor, and that is why they are a little heavier than other makes. C-D puts more into each capacitor.

Question: *Can capacitors be automatically controlled?*

Answer: Yes. One mid-western plant recently installed C-D capacitors hung from the cross beams supporting the roof. A magnetic contactor automatically throws them across the system when certain machines are put into operation.

Question: *Can capacitors be installed temporarily?*

Answer: Yes. Recently we supplied one of the largest capacitor installations in the country. The capacitors were mounted on wooden cradles in an open lot in the back of the plant. After the war, these capacitors will be moved to other focal points of low power-factor on the system.

Question: *What government retrictions control the installati of capacitors?*

Answer: Since they involve some critical materials, they mu be purchased on priorities.

Question: *Capacitors are necessary now — when the demand fo power is greater than that which our generator and feeder syste can supply — but what about after the war? Will capacitors b another white elephant on our hands?*

Answer: No. Capacitor installations will never become whi elephant investments. Not only will they continue to improve th efficiency of the entire system, but they will also continue to pa dividends by maintaining uniformly high power-factor throughou the year, regardless of seasonal power demands.

When you specify capacitors, remember — only C-D's ar experience-built by thirty-three years of specialized capacito engineering. Our engineers will be glad to consult with yo on your specific requirements. No obligation, of cours Cornell Dubilier Electric Corporation, South Plainfield, N.

WORLD'S LARGEST MANUFACTURERS OF CAPACITORS 1910-1943

Cornell Dubilier capacitors

FOR POWER-FACTOR IMPROVEMENT

CORNELL-DUBILIER CAPACITORS

connected in parallel and carried a continuous load, consisting of three electric furnaces producing vital war materials. Since the load was in three equal blocks, a long interruption would have been necessitated to permit working on both transformers simultaneously, or the cutting off of two-thirds of the load if the transformers were worked separately. The job was actually accomplished without any interruption to the service.

Tool Construction

Cutting tool consisted of a cylindrical steel tube, approximately 33 in. long, closed at one end and turned to a diameter to provide a slip or bearing fit through the 2½-in. diameter valve port. The center of the closed end was drilled for the insertion of a ⅝-in. diameter feed rod and this end was milled to a hexagonal cross-section to take a turning wrench.

The hollow cutter head, screwed on the open end of the shaft, was 3 in. long, of the same outside diameter as the shaft, and had teeth beveled to cut deeper at the outside diameter of their cutting groove and thus leave the flange at the bottom of the groove firmly secured to the circular plug which was to be cut from the ⅜-in. steel plate of the transformer tank.

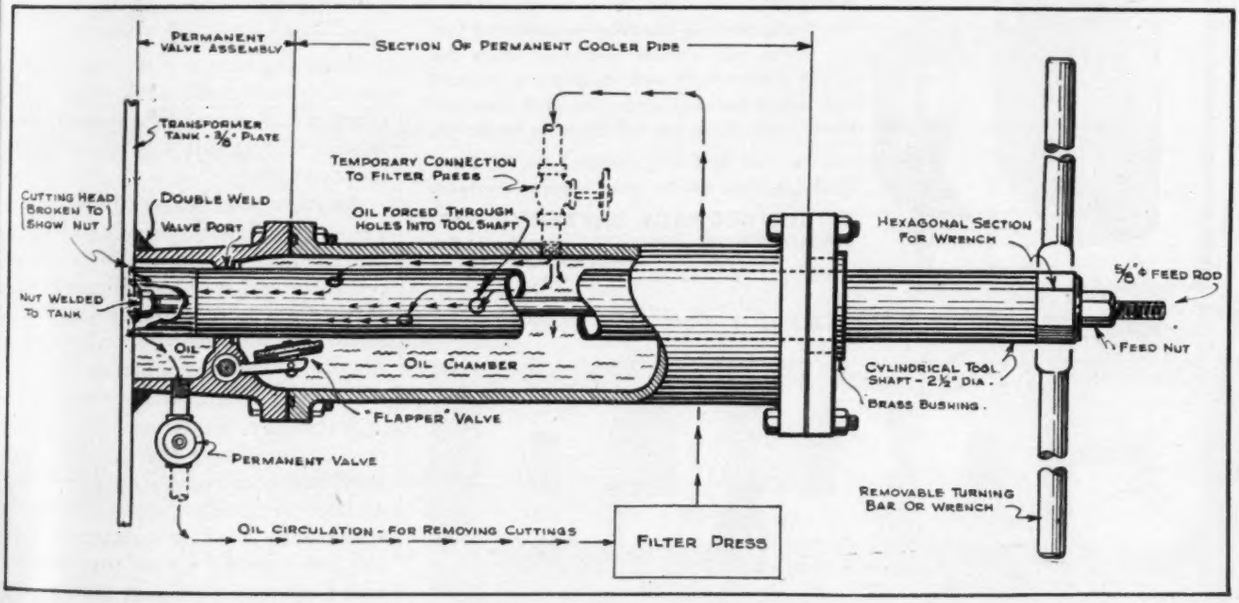
Center for the valve port was located on the transformer tank and a ⅝-in. hexagonal nut was welded on this center. The valve section was then double welded to the tank, with the valve port centered over the nut. A ⅝-in. steel rod 3 in. longer than the tool assembly, and threaded at both ends, was inserted through the valve port and threaded into the weld nut. The hollow shaft was then slipped over this rod and through the valve port until the teeth were against the tank. A feed nut was threaded on the end of the rod. A section of flanged pipe (approximately 18½ in. long) was then bolted in place and the outside end covered with a bolted steel plate with a brass bushed hole for the cutting tool, making an almost oil-tight fit.

TANK-CUTTING TOOL installed and ready for operation

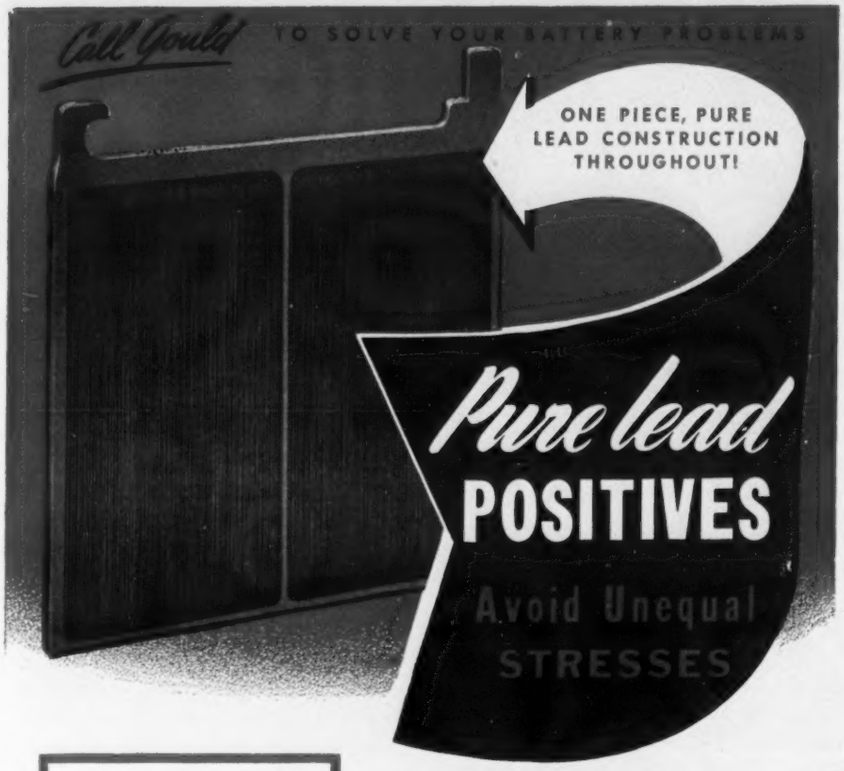
A ½-in. pipe valve was permanently installed in the bottom of the radiator valve and another tapped in the center of the flanged pipe. A small oil filter press was connected to the two valves and transformer oil circulated under pressure through holes in the tool shaft and out between the cutting teeth to be returned to the filter, which was provided with a sump and strainer to catch the steel cuttings.

The tool was rotated slowly by two men, while a third man maintained a cutting feed. When the cut was almost through the tank, by measurement of take-up of the feed nut and "feel" of the tool's cutting, the tool was withdrawn to clear the teeth of the cut and oil circulated to remove all cuttings. The oil filter hose was connected to eliminate the inflow. Thus, when the final turns of the tool cut the disk free, oil from the transformer flushed the final cuttings out into the valve chamber, where they were drawn out by the filter. About 5 gal. of oil from the transformer sufficed to remove the last trace of steel cuttings. The tool, with the cut-out plug secured in the end of the cutter head by the feed rod, was withdrawn to clear the valve cover, the valve was closed and the pipe section and tool removed.

Actual cutting time for each hole was about 30 minutes and the labor required was a small fraction of that which would have been required to empty the tanks. The cost of the shop-made tool was negligible in comparison to the cost of handling the oil. The method described proved entirely safe, which, incidentally, was thoroughly demonstrated by a shop test prior to the actual work, and the installations have been time tested by several months of service.



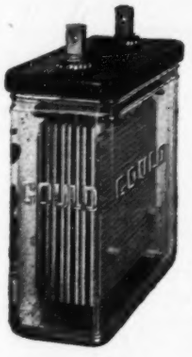
OUTLINE OF TOOL for cutting transformer tank



Are you receiving the monthly informative "Gould Battery News"? If not . . . ask for it.

•

Rated conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.



FIRST CHOICE

• In the manufacture of Gould Plante positives, blanks of pure lead are reciprocated between high speed revolving discs until they form a finely ribbed surface. Then they are electro-chemically treated in the presence of a secret accelerator to rapidly build up a uniform surface film of pure lead peroxide.

This in its essentials, is the secret of the extra long life of the Gould Plante plate. Pure lead is the sole metal used in its construction. There is no supporting framework of antimony lead to set up a dissimilar strain in the positive plate. The chemical reaction of charge and discharge in the pure lead Plante plate is equalized over the entire area. Thus any tendency towards plate fracture due to unequal expansion and contraction is completely eliminated.

The Gould Plante is especially designed and built for control and standby operations where the utmost dependability and durability is required over a long period of years. One piece pure lead Gould Plante plates are first choice for this service.

Get the facts on Gould Batteries. Ask for Gould Sealed-In-Glass Bulletin, using business letterhead.

GOULD STORAGE BATTERY CORP.
DEPEW, N.Y. • Factories at Depew, N. Y. • North Bergen, N. J.
Dallas • Atlanta • Chicago • Saint Paul
Leavenworth • Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

EQUALIZING CHARGES

One of a series of service suggestions for users of industrial batteries.

▶ The individual cells of any industrial storage battery tend to operate at varying rates of discharge. This is caused by changed operating conditions and differing internal characteristics within each cell. Such variations are cumulative and, as charge and discharge cycles are repeated, will cause some cells to operate almost constantly in a state of discharge. This is not only harmful to such cells, but if the condition is allowed to continue for some time, reversal is sure to follow.

Reversal, as most users of industrial batteries have learned from bitter experience, seriously reduces the capacity of the battery, for the reversed cell, or cells, is consuming power rather than adding to the total output. More than that it damages the plates of the affected cell to the extent that the unit must be replaced.

The prevention of this condition is a relatively simple matter. Once each week a battery that is in constant use for operating industrial trucks, tractors, mine locomotives, or any other battery propelled vehicle, should receive an equalizing charge. This is given by continuing a "regular" charge from a normal end at a rate not to exceed the "finish" rate, and it may be somewhat lower. This charge is continued until all cells gas freely, and until three consecutive readings of specific gravity and cell voltage, taken at half-hourly intervals, show no further increase.

Batteries that are not in constant use do not require weekly equalizing charges but, even in these cases, they should receive this attention at regular intervals.

Another good battery practice is to keep a card record system showing the gravity and voltage readings of each cell at the end of the equalizing charge. If there is a progressive downward trend in the gravity readings it is usually a sign of trouble, such as sulfation or leakage, within the cell.

Stationary batteries also require periodic equalizing charges. This, however, is a more complicated procedure and difficult to describe in this limited space. Interested persons may receive full information by writing the Service Department, Gould Storage Battery Corporation, Depew, New York.

(Advertisement)

A GUIDE FOR INSPECTION OF PHOTOELECTRIC CONTROL

By E. B. McDOWELL, Electronics Section, Industrial Control Engineering Division, General Electric Company, Schenectady, N. Y.

Item to be Inspected	When to Inspect	What to Inspect For
Vacuum tubes	Every 3000 hours	In order to maintain continuity of service, all radio-type vacuum tubes should be tested and replaced if necessary.
Light-source lamps	1000 to 3000 hours	To prevent shutdowns caused by lamp burnouts, replace lamp each 1000 to 3000 hours, depending upon voltage applied. (Refer to instructions with equipment).
Contacts of magnetic relay	1 to 3 months, depending on frequency of operation	Excessive wear, burning, or pitting. Replace contacts if necessary. Amount of wipe on normally closed contacts of sensitive relays. Bend armature stop to obtain about 1/16-in. clearance between armature arm and contact spring.
All glass or plastic surfaces through which light passes or from which it is reflected, such as lenses, phototubes, windows, and mirrors	1 to 6 months, depending on local conditions	Dust, oily film, or any foreign matter which restricts the passage of light. Clean the surface. If oil film is present, use a suitable solvent. Since plastic surfaces are quite soft, care must be taken not to scratch the surface. Such surfaces should be cleaned with an air supply or dusted lightly with a cloth or brush. If necessary to use water or solvent, rub surface very carefully so as not to cause abrasive action of material being removed from surface. Replace all glass or plastic parts which have become scratched or broken.
Control panel, phototube holders, and other auxiliary electronic equipment.	1 to 6 months	Presence of dirt, metallic dust, and other foreign material. Because of the high impedance of most electronic circuits, such accumulations may cause trouble. The presence of moisture will make the condition much worse. Particular attention should be given to the phototube portion of the circuit, since the effective impedance of a phototube may be 50 to 500 megohms. Therefore, any leakages in associated cables, sockets, or panel surfaces must be in excess of several thousand megohms.
Light sources, phototube holders, apertures, mirrors, and other parts included in the optical system.	1 to 3 months	Proper alignment of these parts. Equipment subjected to vibration may develop loose supports, or it may be accidentally struck by some object and knocked out of position.
Connections to terminals and plug connections.	3 to 6 months	Under conditions of vibration these connections may work loose. Tighten securely.
Air filter.	1 to 3 months, depending upon local conditions.	Air filters on ventilated cases should be cleaned out and replaced. If filter is of a type which cannot be cleaned, replace with new filter.
Mechanical auxiliaries used with photoelectric equipment.	3 to 6 months	Contact wear, loose parts, proper lubrication, etc.

Inspection schedule lists items to be checked at each inspection and the frequency of inspection. A trouble-shooting chart will be presented in a subsequent issue

Special Design for High-Tension Fuse

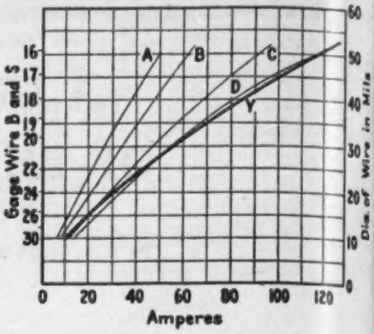
Accompanying drawings show details of a special type of 60-kv. fuse that has been used successfully on the system of the Kansas Gas & Electric Company system for the past 25 years. Design of this fuse is of interest in wartime since it uses a minimum of critical materials and can be fabricated by local shops and foundries from generally available materials at low cost. The fuse is reported to co-ordinate well with all relays in use on the system.

Fusible elements of the assembly is solid copper wire, size of which is selected in accordance with the accompanying curves for minimum fusing current of copper wire, established by actual test in the assembly.

The wire which forms the fusible element of the device is threaded through two 3-ft. lengths of 1¼-in. O.D. micarta tubing having a bore of ½ in. The tubes, individually mounted on high-tension pin-type insulators spaced 4 ft. 3 in. on centers, point downward and toward each other to form a shallow V. Apex of the V is not closed, the lower ends of the tubes being 8 in. apart, with the fuse wire passing between them. The fuse wire passes up through the bore of both tubes and is bent back on the outside of the upper tube ends to make electrical connections with the fittings fastening the tubes to caps of supporting insulators, as shown in the illustration below.

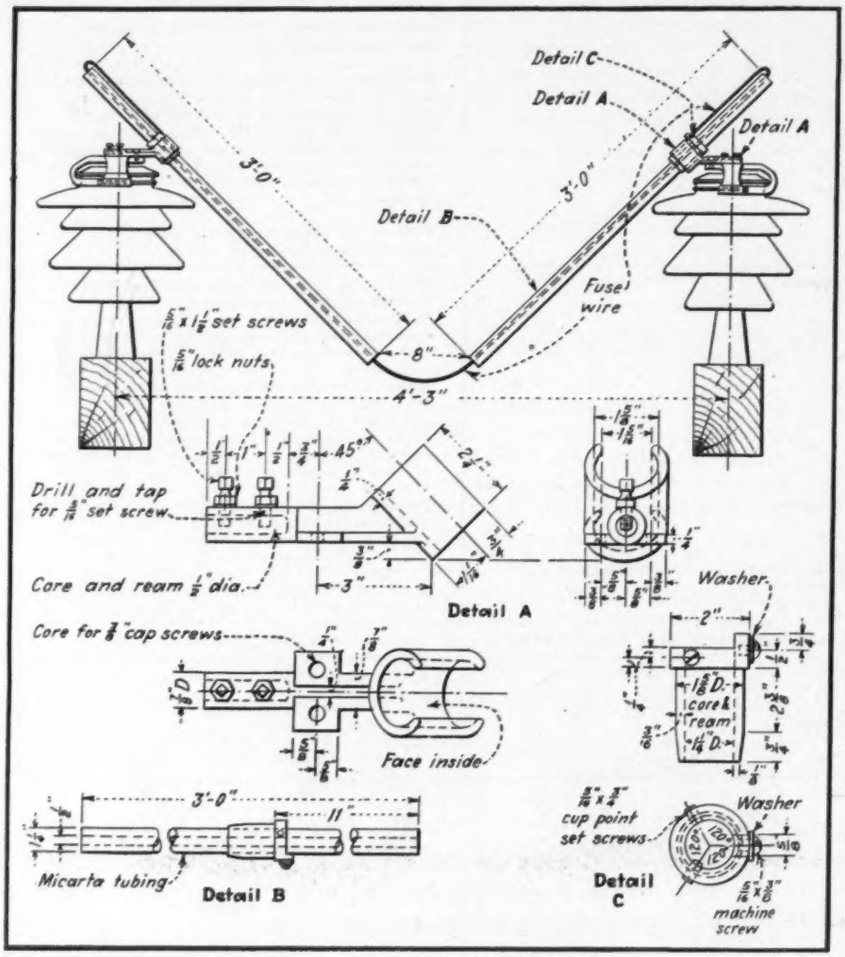
Accompanying curves show (a) maximum continuous current that can be carried by a single fuse wire, (b) minimum fusing current for a single wire, (c) maximum continuous current for two wires, (d) minimum fusing current for two wires and (e) fusing values for a single wire in air.

Using these test curves as a guide, company engineers would normally select a single No. 18 copper wire, having a minimum fusing current value of 48 amp., to protect a 60-kv., 3,000-kva. transformer bank.



MINIMUM FUSING current and maximum allowable continuous current for copper wire sizes used in 60-kv. micarta-tube fuse assembly

A. Maximum current for continuous operation, single wire.
B. Minimum fusing current for single wire.
C. Maximum current for continuous operation, double wire.
D. Minimum fusing current for double wire.
Y. Fusing values of copper wire in operation.



MICARTA-TUBE 60-kv. fuse assembly of special design has fusible element of copper wire; design uses minimum of critical material

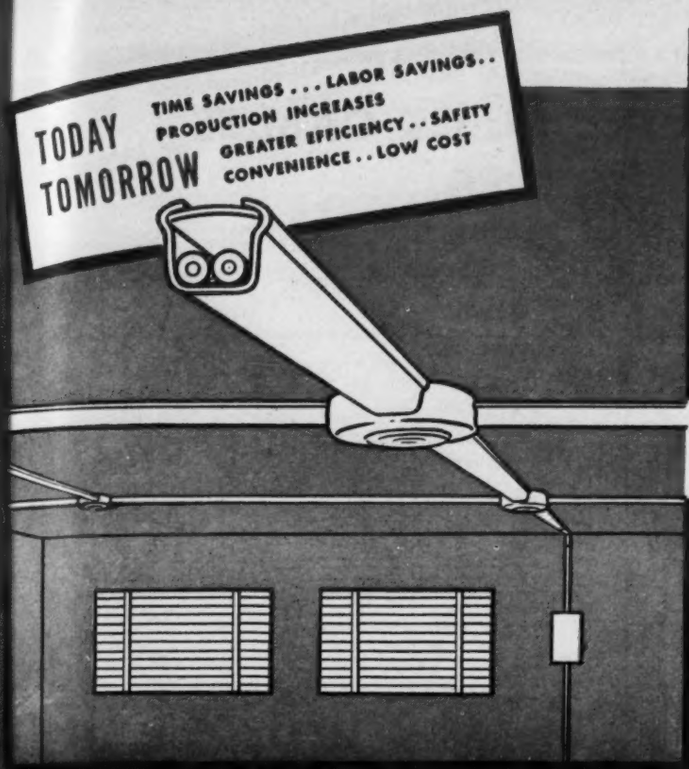
The fuses are reported to "co-ordinate well" with both General Electric and Westinghouse overload type relays used on the system, in most cases operating before the relays trip. The fuses are sequenced with the plug and lever setting of the relays.

•

Serve Row Houses From Secondary Bus

To conserve copper and avoid running individual service to each house in war housing projects in the Louisville, Ky., area the Louisville Gas & Electric Company has resorted to the practice of "jumping" services across property lines from one house to the next. Written permission from the property owner is of course required to maintain a right-of-way across lot lines.

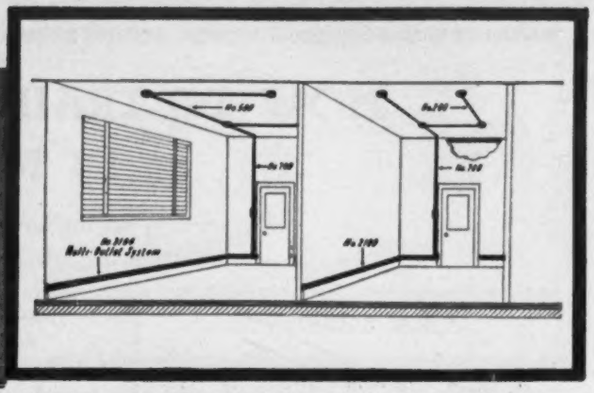
The practice is to run a "secondary bus" of No. 6 or No. 8 weatherproof wire on house knobs under the eves and across the back of the row type war housing units and take taps from this "bus" into the individual houses. A maximum of about ten dwellings can be served in this manner from a single bus connected to the transformer at the mid-point. Buses longer than this are too long from a voltage-drop standpoint.



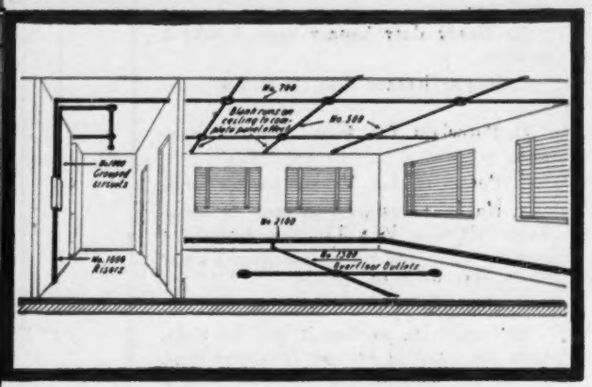
KNOW YOUR

WIREMOLD

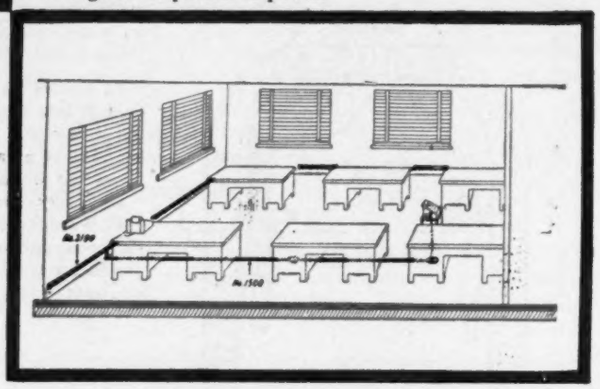
AND YOU KNOW THE ANSWERS



Typical small office, hospital or hotel room installations of WIREMOLD together with PLUGMOLD plug-in-anywhere convenience outlet system.



Installation in larger office or factory working area, showing use of WIREMOLD wiring for light, with PLUGMOLD around baseboards and PANCAKE overfloor wiring for telephones or power.



Installation in executive offices showing PLUGMOLD plug-in-anywhere convenience wiring interconnecting with PANCAKE overfloor wiring to office machines.

●Better lighting, in the factory, in offices, in trade and vocational schools . . . wherever essential productive work and training is being done...is one of the "musts" in the war production program. That entails wiring and rewiring problems that can most easily be solved with basic Wiremold Surface Metal Raceway Wiring Systems . . . quickly, economically installed on the surface . . . with few simple fittings . . . with minimum use of critical materials . . . without, in most cases, disturbing progress of work.

Wiremold is Listed by U. L. and conforms to Federal Specifications W-R-32 . . . assures safe, permanent installation yet can be easily extended or relocated to meet the changing needs that will surely come with reconversion to peace-time operation.

Write for your copy of the Wiremold Catalog and Wiring Guide detailing this and other Wiremold aids to greater lighting and electrical efficiency. **The Wiremold Company, Hartford 10, Conn.**

WIREMOLD

CAN HELP YOU

PRODUCE FOR WAR . . . AND PLAN FOR PEACE

HOW TO TRAIN AND RACK CABLES IN MANHOLES

Accompanying method has been adapted from a book of standardized practices of the Boston Edison Company

CABLE SUPPORTS

A. Cable stanchion. Attach to manhole wall with ⅝ x 4½-in. lag screws and ⅝-in. expansion shields. Use ⅞-in. star drill to install expansion shields. One-sixth position.

B. Heavy duty hanger arm, 2 and 3 position.

C. V-type hanger arm, 2 and 3 position.

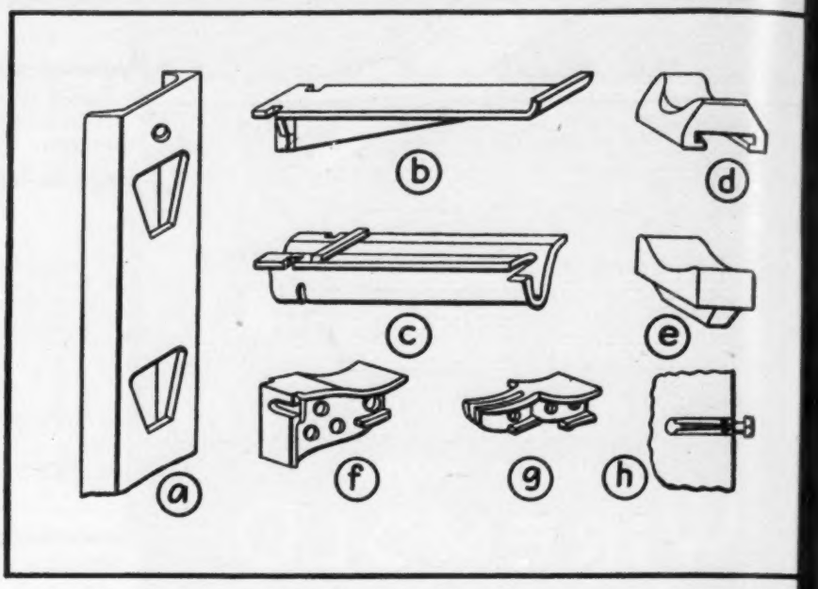
D. Porcelain for heavy duty hanger arm.

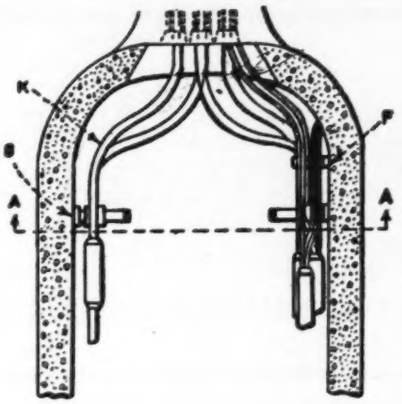
E. Porcelain for V-type hanger arm.

F. Nordyke hanger. Attach to manhole wall with ½ x 3-in. cut thread lag screw and ½-in. expansion shield. Use ¾-in. star drill to install.

G. Extension for Nordyke hanger.

H. Install lag so that it will be tight, with the head ⅜ in. out from the wall. Drive the slot of the Nordyke hanger under the head.





TRAINING CABLES

K. Cables up to 10 kv. should be bent to a radius of not less than eight times the diameter. Cables over 10 kv. should be bent to a radius of not less than ten times the diameter.

B. Heavy-duty hanger.

F. Nordyke hanger and extension (for single-conductor cables). Install multi-conductor cable over 2 in. in diameter on heavy duty hanger arms.

NOTE—In general all cables 2 in. in diameter or over should be racked on heavy-duty hanger arms. All cables under 2 in. in diameter should be racked on Nordyke hangers. If cables under 2 in. in diameter are to be racked and cable stanchions have been installed in the manhole, the V-type hanger arms should be used in place of installing Nordyke hangers.

RACKING CABLES

N. Ducts are numbered from left to right, starting at the top left hand duct.

Street-lighting cables should be installed in the upper ducts and racked on the upper hanger arms when possible. If an empty duct is not available for street-lighting, the multiple circuit should be installed with the secondary cables and the series lighting circuit should be installed with the primary cables.

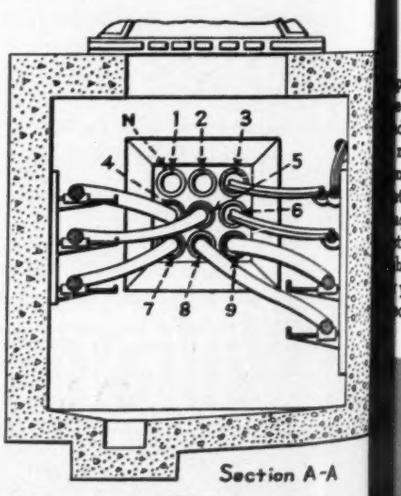
NOTE.—Multiple conductor cables (large sizes) should not be double racked on any hanger if avoidable.

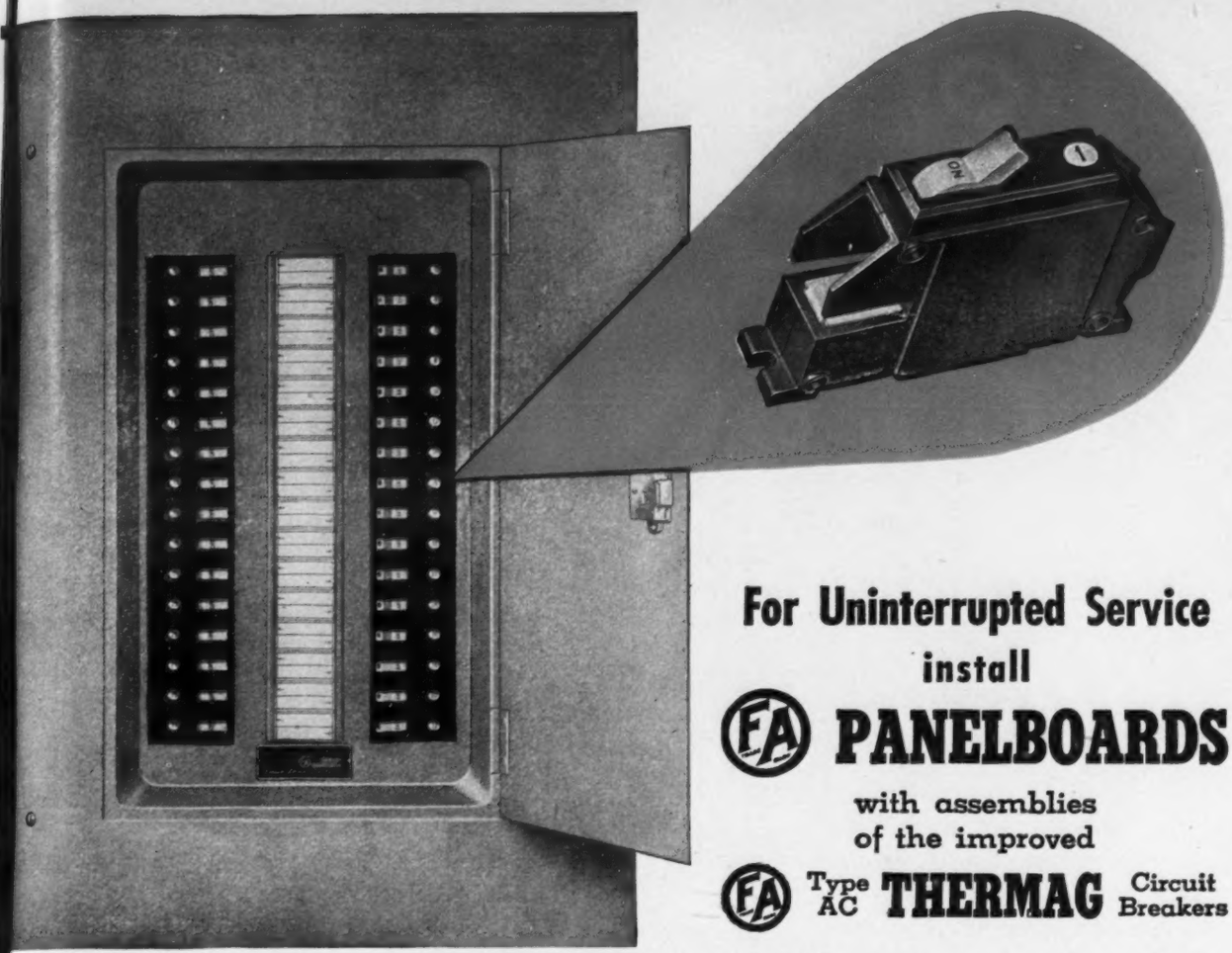
Transmission lines and distribution supply lines should preferably be installed in the lower ducts and racked on the lower hanger arms. Ducts for these lines in the order of preference for most favorable heat dissipation would be 7 or 9-8-4 or 6, 1 or 3-2-5.

D. C. feeders same as transmission lines.

Primary distribution cables should be installed in the center ducts and racked on the center hanger arms when possible.

Secondary distribution cables should be installed in the upper ducts and racked on the upper hanger arms when possible.





For Uninterrupted Service install FA PANELBOARDS

with assemblies of the improved FA Type AC THERMAG Circuit Breakers

e Safety Panelboard above is talog No. FA NAC1B32-3L20. It tains 32 FA Type AC Thermag rcuit Breakers, and 200 ampere ire main connection. An en- ged view of the individual Cir- Breaker is shown at the right.

They not only provide full protection against short circuits and dangerous overloads, *but prevent unnecessary interruptions in service* due to momentary or slight overloads.

The combination of the time-tried THERmal trip with the new MAGnetic trip, in the individual circuit breakers, assures this double protection. On harmless, momentary overload the time lag characteristics of the thermal element prevent interruption of service, but trip on sustained, harmful overload. On short circuit, the magnetic element causes *faster* tripping.

When tripped, the handle of the single pole breaker automatically returns to the OFF position, thus indicating the circuit affected. On the double pole breaker, a red signal button is protruded from the face of the breaker on which the trouble has occurred.

FA PANELBOARDS—THERMAG EQUIPPED

are made in Standard Type, Narrow Column Type, and Dust-tight Type construction. They are available with from 4 to 42 circuits, for either flush or surface mounting . . . Capacities: 50 amperes or less, 120 volts AC, single or double pole, individual trip . . . Approved by Underwriters' Laboratories, Inc.

Installation and connection are facilitated by new and improved FA Pressure Connectors. Ample knockouts are provided in the steel boxes. Fronts are bonderited, to prevent rusting, and finished in pearl gray lacquer.

Write for BULLETIN 69

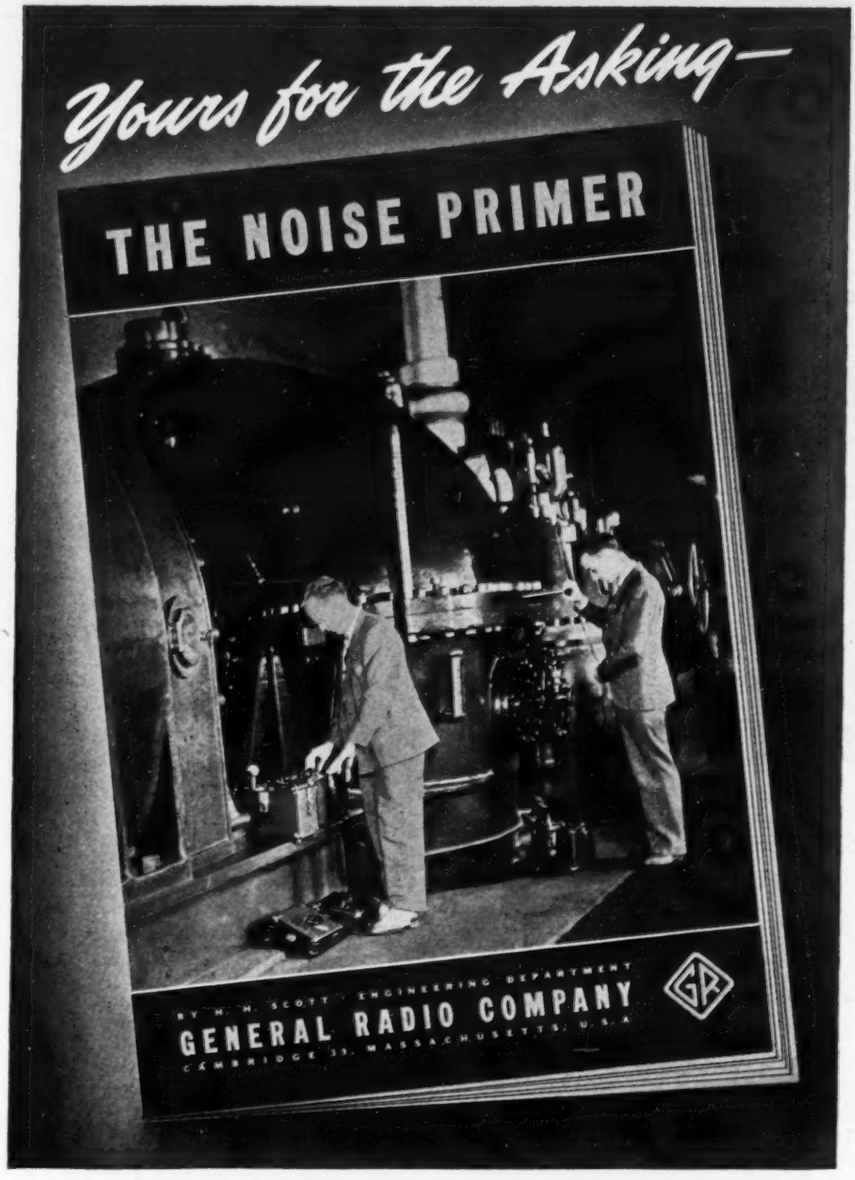
pecially prepared for the e of Architects, Engineers d Contractors, it contains mme of useable informa- n on panelboards and cab- ts. It is a real aid in plan- g and engineering electric tribution installations for ht, heat and power. Write your copy . . . Frank Adam ctric Co., St. Louis, Mo.

EST. 1891 THE SIGN OF A FA BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS for War Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.



Ask for THE NOISE PRIMER No. 846

In the technical, as in the medical field, diagnosis precedes treatment. For your "doctor" of noise and vibration, the first step is a thorough examination and accurate measure of all contributing factors. How to measure and to analyze acoustic noise and mechanical vibration is simply told and illustrated in the 48 pages of THE NOISE PRIMER now available on request and without charge. The book is a compilation of a series of articles on the subject which have appeared recently in the General Radio *Experimenter*.

To your engineering or production staff, THE NOISE PRIMER may suggest a simple, practical approach to the insistent demand for quietness and freedom from vibration.

GR GENERAL RADIO COMPANY
Cambridge 39, Massachusetts
NEW YORK CHICAGO LOS ANGELES

How to Close, Trip Circuit Breakers

10. Direct Transformer Tripping*

By G. J. EASLEY
Switchgear Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Simplest method of tripping without a battery is through use of a transformer trip coil operating directly from the bushing current transformers on the breaker. Three tripping magnets are used (one per phase) with the light-trip attachment, shown schematically in Fig. 1. The

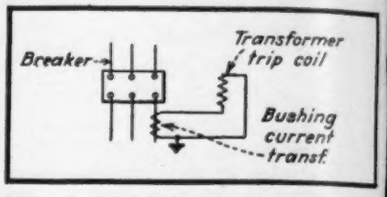


FIG. 1—Schematic diagram for direct transformer tripping of circuit breaker

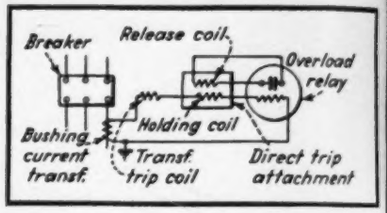


FIG. 2—Schematic diagram of transformer tripping using direct-trip attachment and overload relay

two other phases are identical with the one indicated.

The tripping magnets are normally calibrated to trip on secondary currents of 5 to 9 amp. The setting may be changed by raising or lowering the moving core; the shorter gap permits a minimum pick-up of 5 amp. and the longest gap increases the minimum pick-up to 9 amp. By using the proper combination of gap-setting and current transformer tap the breaker will trip at or above the fault current selected. Since there are no relays to introduce time delay, the scheme described is instantaneous.

Delayed tripping may be obtained by adding an inverse-time-limit attachment to each tripping magnet. This attachment consists of a small oil dashpot attached to the trip plunger. The time delay is adjusted by changing the port opening, which regulates the rate of oil escapement. On inverse-time-limit devices the trip-

*Tenth in a series of twelve articles which began in August 7, 1943, issue of "Electrical World."

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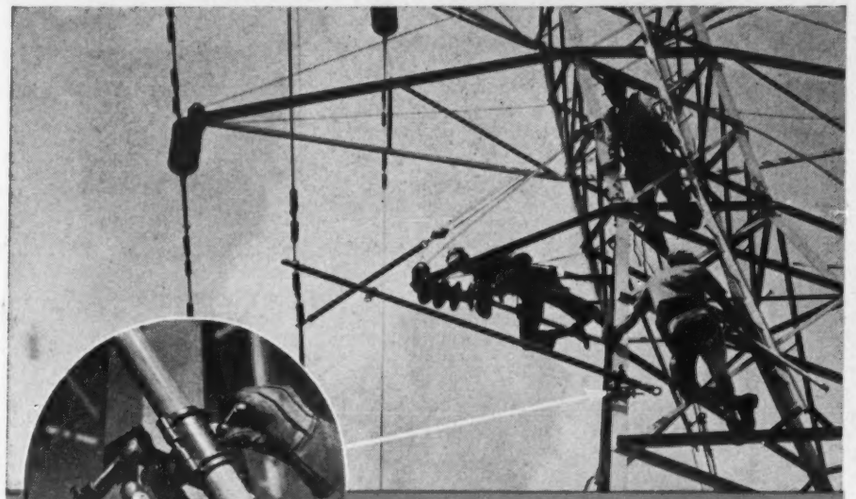
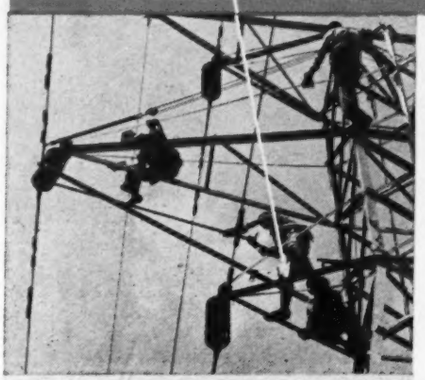
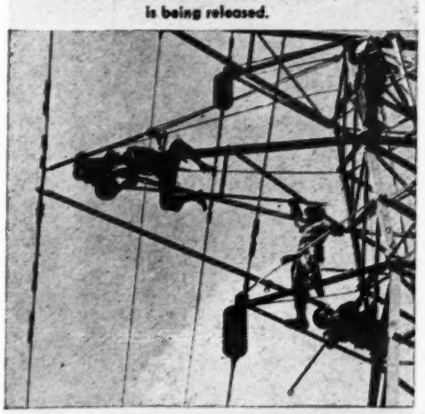


A simplified method for changing tower suspension insulators "hot" with...

TIPS TOOLS



This photo shows how the tower leg clamp can be used on the arm as well as on the tower leg as illustrated above. Here the cotter key is being released.



After the cotter key is released the conductor is pushed to a safe distance and a lineman pulls the insulators up to make the necessary changes. A "shepherd hook" is sometimes used for lifting.

Tower leg clamp reduces need for special tools . . .

Hot line maintenance crews that are equipped with Tips wire tongs for regular straight line repair work can add a tower leg clamp (shown in close-up), an insulated link stick and cotter key tools to this equipment and be all set to handle tower suspension insulators. With these additions they can use Tips wire tongs to clear the way for removing and replacing tower suspension insulators without interrupting service.

This method, as illustrated, eliminates the need for special suspension equipment and in many cases the job can be handled much quicker than by the suspension link stick method.

The tower leg clamp permits the wire tong to turn at almost any angle to contact the conductor. The link stick suspended from above by rope blocks, provides insulation protection and carries a big part of the load. The small cotter key tools required are readily attached to an insulated "universal" pole.

This method can be used successfully and in complete safety on practically all tower suspension work. For those few exceptions, Tips suspension link sticks are still available.

Consult your Tips Tool catalog for the details on complete equipment or the extras needed.

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ping time varies inversely with amount of overload; in other words large overloads cause faster tripping because the pull on the trip magnet is greater. This method provides an inexpensive set-up which is satisfactory for many feeder circuits where accurate selective relaying is not important. It may be simplified further on small low-voltage breakers by eliminating the bushing current transformers and by placing trip coils (one per phase) in series with the main line.

The direct-trip attachment was formerly used quite extensively for small breakers as a means of using protective relays to obtain proper tripping characteristics, but has since given way to other more satisfactory schemes. The direct-trip arrangement is shown schematically in Fig. 2.

•

Shielded Room for High-Voltage Tests

By R. H. TITLEY

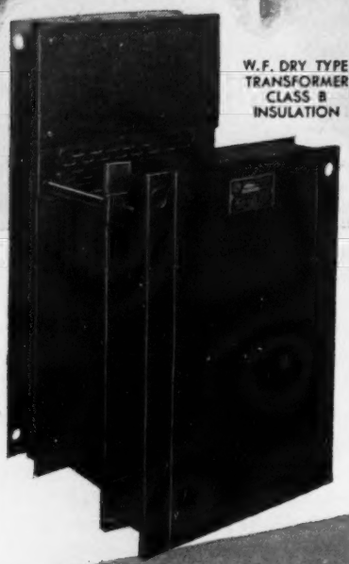
Materials Division Chief, Testing Laboratory, Public Service Electric & Gas Company, Maplewood, N. J.

To determine radio interference characteristics of bushings, pin and suspension insulators it is necessary to conduct high-voltage tests in a room which is completely shielded with a non-magnetic metal lining. This metal shield isolates the insulator under test from external electrical disturbances. Also emanations from the insulator under various voltages can be accurately detected. In the high-tension testing room of Public Service Electric & Gas Company's new testing laboratory at Maplewood, N. J., there is such a room.

This room is 16 ft. long, 9 ft. wide and 16 ft. high inside. No. 10 gage copper sheet was used for shielding, lining the interior of the room—that is, the ceiling, four walls, two doors and the entire underside of a 4-in. concrete floor. The edges of the copper sheets are fastened together by interlocking joints. The lining is connected to a ground bus through copper straps at the top of one door. At one end of the room and inside the electrostatic shield is the observer's instrument booth, constructed of transite, with one wall and roof across the width of the shielded room. A plate glass window in the transite wall enables the

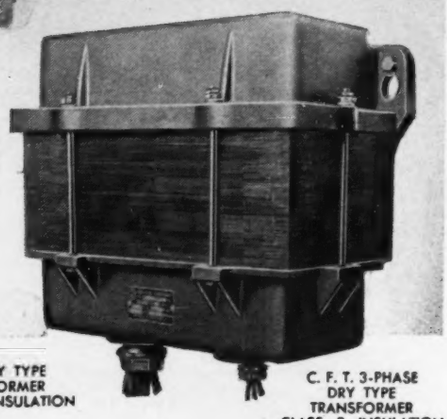
TRANSFORMERS

on the job... at the job!



W.F. DRY TYPE TRANSFORMER CLASS B INSULATION

C. F. DRY TYPE TRANSFORMER CLASS B INSULATION



C. F. T. 3-PHASE DRY TYPE TRANSFORMER CLASS B INSULATION

AmerTran Dry Type Transformers are made in a variety of ratings for a wide range of applications. Small and light, they permit installation at nearest available location to load center. Thus, they save secondary copper, reduce line losses, obtain improved voltage regulation and gain added load flexibility for future demands.

Their incombustible insulation (glass, porcelain and asbestos) eliminates the need for vaults—saving space as well as installation costs. Their higher permissible temperature rise (80 degrees C.) allows heavier loads on the windings. With no liquid to drip, they can be placed overhead, if desired. And maintenance is practically nil since there is no sampling or changing of liquids, no watching or servicing valves, diaphragms and gaskets.

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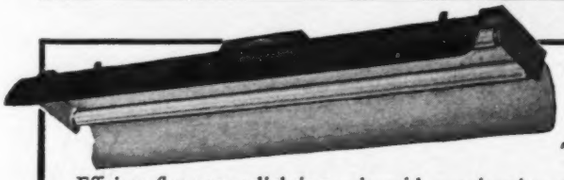
SILV-A-KING RLM STANDARD DOME REFLECTORS

One-piece, drawn or spun, seamless steel reflector completely vitreous porcelain enameled, white inside, green outside. Highly efficient. Permissible spacing for these units, one-and-one-half times the mounting height. Made in sizes 12" to 20", 75 to 1,500 watts.

SILV-A-KING RLM DEEP BOWL REFLECTORS

Porcelain enameled finish on reflecting surface assures high-efficiency lighting and easy maintenance. Recommended for installation where spacing of units does not exceed mounting height. Made in sizes 8" to 16", 60 to 1,500 watts.



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Efficient fluorescent lighting units with metal-saving reflectors of non-critical Silv-A-Tex. Units conform to all RLM Standards. High-gloss baked enamel reflecting surface comparable in efficiency to porcelain enamel. Silv-A-King "Victory" Units provide even, glare-free light for recommended "daylight" illumination or for supplementary lighting of individual machines or work areas.

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High efficiency, porcelain enameled reflecting surface. Units designed for angular distribution of light for illumination of vertical surfaces, such as walls, signs, etc. Made in sizes 8" to 16", 100 to 1,500 watts.

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observer to watch the progress of the test.

Test voltage is brought into the shielded room through porcelain bushings from the test transformer. Readings of radio interference are made with a Ferris Model 32-A radio noise and field strength meter.

The insulators may be tested dry or under standard conditions of rain as set forth by the American Institute of Electrical Engineers' specification for insulator tests. Insulators also may be tested in an atmosphere of fog produced by syphon type atomizing nozzles. These nozzles are designed to disperse 2.75 gallons of water per 100 cu.ft. of air space.

Radio noise levels are measured at various steps of applied voltage permitting the plotting of a curve of applied voltage versus radio noise level.

In addition to the foregoing tests the voltage at which the first evidence of corona or brush discharge is seen is also determined in this room.

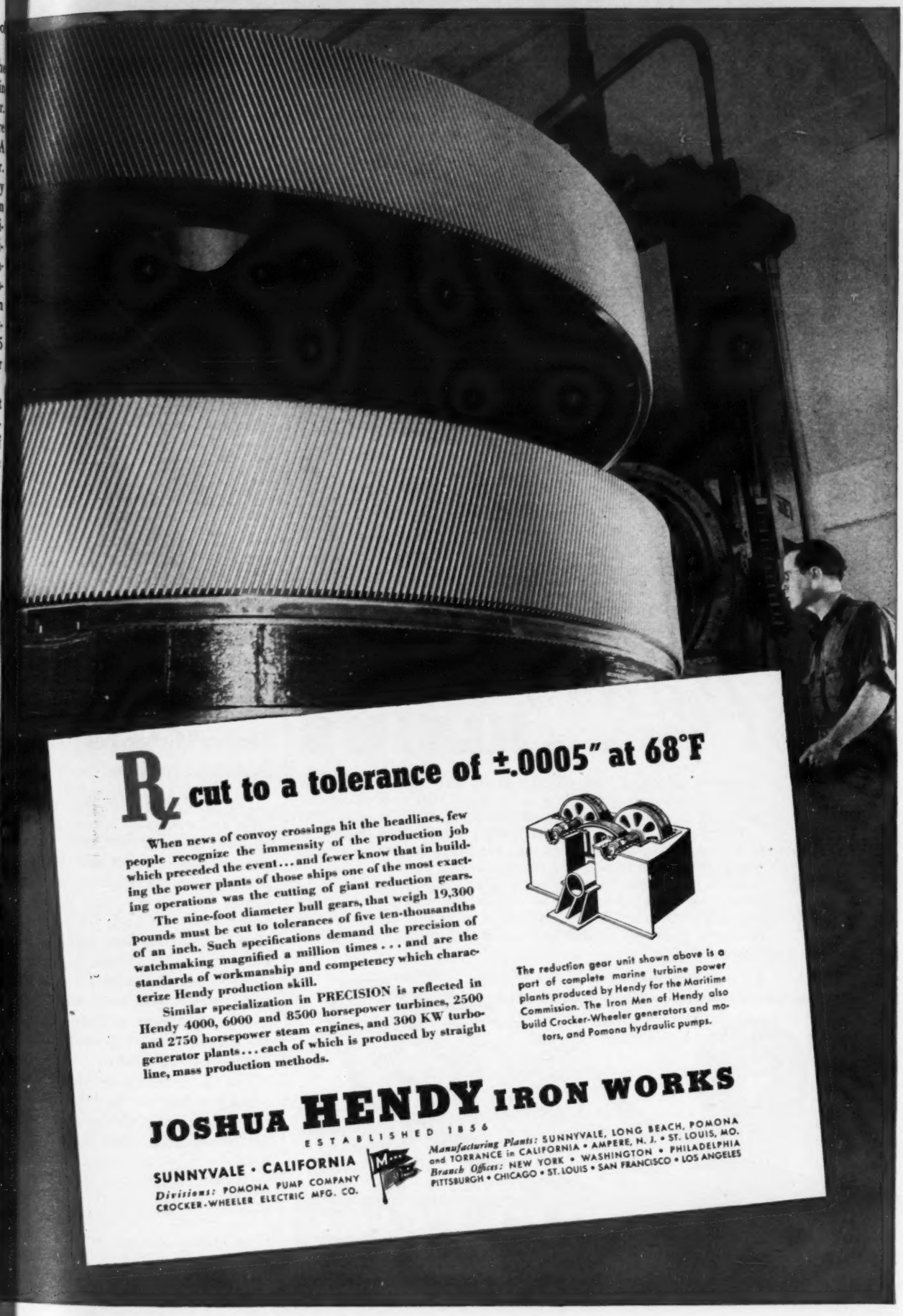
•

Paper Beats Steel for Conduit Joint Rings

Paper rings impregnated with waterproofing material are being successfully substituted for the steel bands formerly used on the Commonwealth Edison underground system to cover joints between stone conduit and hold them in line until the enveloping concrete sets.

Until the war cut off the supply the Chicago company used "conduit joint rings" of either zinc alloy or steel. The steel rings rust out promptly and do not leave a short-circuited loop of magnetic material on the outside of the conduit and inclosed cable. For the common 4-in. conduit a $5\frac{1}{16}$-in. diameter ring $1\frac{5}{8}$ in. wide was used. The rings, made of No. 28 gage steel, were pre-fabricated and crimped.

Spirally wound paper collars that have been resorted to as a wartime substitute are said to serve the purpose equally well, are non-magnetic and cost much less than the steel bands. For the 4-in. conduit size a 5.3-in. diameter paper ring $1\frac{5}{8}$ in. wide and $\frac{1}{8}$ in. thick is used. Some of the company engineers doubt that steel rings will be used again for the purpose after the war.



Rx cut to a tolerance of ±.0005" at 68°F

When news of convoy crossings hit the headlines, few people recognize the immensity of the production job which preceded the event... and fewer know that in building the power plants of those ships one of the most exacting operations was the cutting of giant reduction gears.

The nine-foot diameter bull gears, that weigh 19,300 pounds must be cut to tolerances of five ten-thousandths of an inch. Such specifications demand the precision of watchmaking magnified a million times . . . and are the standards of workmanship and competency which characterize Hendy production skill.

Similar specialization in PRECISION is reflected in Hendy 4000, 6000 and 8500 horsepower turbines, 2500 and 2750 horsepower steam engines, and 300 KW turbo-generator plants . . . each of which is produced by straight line, mass production methods.

The reduction gear unit shown above is a part of complete marine turbine power plants produced by Hendy for the Maritime Commission. The Iron Men of Hendy also build Crocker-Wheeler generators and motors, and Pomona hydraulic pumps.

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For Your Post war planning ... KLEIN'S

This booklet on the care of tools is a Klein contribution to making tools last longer—give better service. Write for a copy.

Victories on many fronts point to the day when power and communication companies will be faced with the peacetime problem of extension and re-habilitation.

Today many utility companies are planning for the future and these plans of necessity call for high quality tools and equipment, for linemen and electricians.

Mathias Klein & Sons are busy making the tools and equipment they have always made. When the war is won, this capacity will be available to produce tools and equipment of the same high quality that has characterized the name Klein "since 1857."

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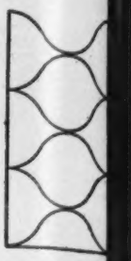
Bow Braces Make Warehouse Pipe Rack

Those old-fashioned crossarm braces, formed out of narrow angle steel into a flat, round-bottom U about 5 ft. spread, have found a different use in the warehouse of the Virginia Electric & Power Company, at Richmond.



PIPE AND ROD RACK made of bow type crossarm braces

A dozen and a half of these braces, plus a few straight pieces of angle steel, became the structural material of a sturdy rack for holding lengths of pipe and rod.

Six of the braces are joined together at ends and centers in the manner shown in the sketch to make a panel. Three such panels, center and ends, are joined by suitable horizontal cross-members to make the rack which is about 15 ft. long. The rack thus contains twelve separate holding spaces for different kinds and sizes of pipe or rod.

Gang Meter Test Is Conclusive

For final check on repaired, rebuilt and converted meters in which errors of register gear ratio and coil ratings might occur, the meter department of the Birmingham (Alabama) Electric Company has a 60-meter gang test rack. There are six rows, each of ten meter positions, one above the other. Three permanently installed check meters are connected to two rows each, 20 positions wired with current coils in series. Jumpers are provided so that fewer than 20 meters may be checked.

The check meters are equipped with contact points so that they will cut out themselves and the meters connected with them after registration of a fixed number of kilowatt-hours. The registers of the meters under test are set back that number of kilowatt-hours before being placed in position. Then at the end of the test each meter should read zero. If any do not, then there are register or other errors in them.

Die Cast in Aluminum by Alcoa

ALUMINUM provides light weight with high strength, fine appearance, resistance to corrosion, permanence of dimensions and shape, and ability to withstand high temperatures. Manufacturers of electrical equipment have learned to depend on all of these properties of aluminum to improve the performance of their equipment.

DIE CASTING procedures permit accurate rendering of every design detail. Parts may be economically produced in large quantities with extremely close tolerances, thin sections, and smooth surfaces, which are readily adaptable to a number of finishes. Inserts and integrally cast fastening devices add to the economy of die castings. Aluminum parts can be die cast so clean and close to size that machining operations are greatly reduced and often totally eliminated.

ALCOA, as the producer of Alcoa Aluminum Alloys, makes certain that you receive the material best suited to each use. Alcoa engineers are expert in the design and construction of dies—proper techniques and controls have been worked out—assuring you of sound, uniform products when you buy Alcoa die castings.

Whether you're working on materials for war or looking ahead to peacetimes, let us advise you on the use of Alcoa Aluminum Alloys and Alcoa die castings. Write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pa.

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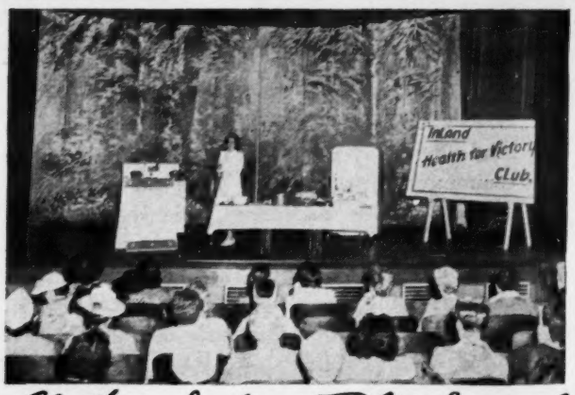
With the Monthly Meal Planning Guide as their textbook, these earnest club members learn valuable facts about food that builds health.

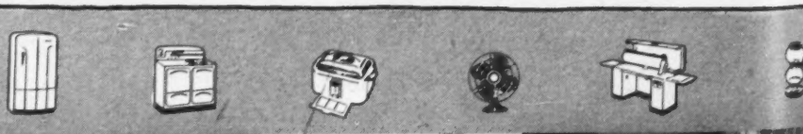
MORE STEEL FOR VICTORY. THAT'S WHAT H-FOR-V MEANS TO THIS DETERMINED INLAND STEEL GROUP

Nutritious, health building meals for Inland Steel workers result from meetings like this one held in the auditorium of Washington High School, East Chicago, Ind.



Northern Indiana Public Service Co.

Health-for-Victory



Food is a weapon of war. We Americans are called upon to feed not only ourselves, but to help feed our fighting allies. If there is to be enough food we must "Produce and Conserve, Share and Play Square." This calls for intensive and intelligent education on the proper use of food.

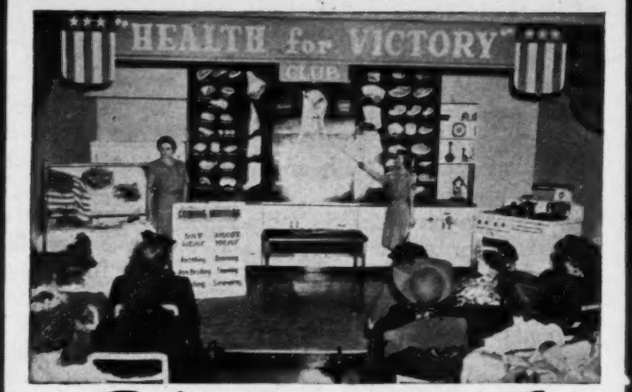
Many electric utilities are already engaged in this vital work of food education. It is a job that is made to order for their home service departments and their public contact facilities.

For example, over 1300 war plants and other organizations are now using the Health-for-Victory nutrition program, and in many of these plants the program is receiving the active support and sponsorship of the local utility. This program is flexible and lends itself perfectly to local requirements.

Each month, as part of the H-for-V program, more than 500,000 Meal Planning Guides—64 pages of menus, recipes and food tips—are made available, at cost, through utilities. Many are given out at utility-sponsored H-for-V meetings. Others are mailed or handed out by industrial relations departments and labor-management committees.

All H-for-V materials are prepared by the Westinghouse Home Economics Institute and are backed up with a wealth of field experience. Electric Utilities are invited to use the H-for-V program. It is immediately available and fits perfectly into the plan recommended by EEI and the Council of Electric Operating Companies for co-operation with the Food Distribution Administration.

Dayton Power & Light Co.



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PLANTS IN 25 CITIES... OFFICES EVERYWHERE

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Group Replacement of Street Lamps

By S. S. BRADFORD
Potomac Edison Company, Hagerstown, Md.*

For series circuits, the old burnout or breakage replacement plan in effect on the Potomac Edison system resulted in 2.4 replacements per lamp fixture per year. The standard line of lamps with a 2,000-hour rated laboratory life was used, resulting in an annual cost of $13,600 for labor, mileage and lamp replacements.

The group replacement plan using the designated lamp with a rated laboratory life of 3,000 hours (average life in service, 2,250 hours) was estimated to produce the following results: Approximately two replacements per street-lighting fixture per year (2,100 burning hours per lamp), resulting in a combined annual labor, mileage and lamp cost of $8,600. Experience, so far, allows the extension of burning hours to 2,200.

However, the group replacement lamp requires a somewhat higher wattage to produce comparable lumen output. This resulted in an increased energy cost of $3,600, applying the regular street-lighting energy rate, making the total replacement cost $12,200. The indicated saving over the old burnout replacement plan was $1,300, or about 10 percent annually.

The new plan was introduced in September, 1942. Actual savings have not been completely checked as yet, but partial analysis indicates a saving greater than 10 percent.

With respect to multiple street-lighting installations the results were even more favorable.

But this is not the full story. Group replacement lamps cost more than the old lamps, but last longer. The result is that total lamp cost averages the same as before. Increased energy cost is material. Resulting saving in labor and mileage is about two-thirds of the former costs. This is important in terms of man-hours and transportation, especially today, when both labor and car mileage need to be conserved to the utmost.

There have been other results of great importance. Outages have been reduced to less than 10 percent for burnouts and give promise of shortly approximating 5 percent for breakage, although these figures were not reached immediately. Introduction of the group replacement plan and the closer subsequent supervision served to bring to light a number of poor regulator and defective lighting arrester conditions, causing short lamp life. Also, bad breakage conditions were isolated and largely corrected with help of the local police. Close supervision would prevent these conditions, yet in a rural area, having many small towns, they can easily develop and go on for a long while without correction. Simple control records now take care of this.

Before this plan was introduced we contacted the mayors and lighting committees of the various communities, telling them of the better service they would get. Results have been very satisfactory; indeed, a number of these civic officials have complimented the company on the improved service through minimum outage of lamps.

The group lighting replacement plan is especially desirable where several small towns are serviced by one man.

*From paper to Southeastern Electric Exchange.

•

"Swap" Plan Uncovers 5,857 Idle Appliances

By T. O. McQUISTON
Director Sales Promotion,
Duquesne Light Company, Pittsburgh, Pa.

Pittsburgh electric dealers have uncovered 5,857 idle appliances in five months under the "Swap Your Old Appliances for War Stamps" plan. Like any new business venture, the program started at a snail's pace and gradually gained momentum. In the first two months the dealers recovered only 1,718 pieces of equipment. Since then the volume of business has steadily increased.

In the light of the serious shortage of laundry equipment it is interesting to note that 41 percent, or 2,418, of all the appliances received by dealers were hand irons. Included also were 459 washers, 542 cleaners, 135 electric refrigerators, 429 radios, 545

THE Grimes electric store has a typical display of restored appliances that were swapped for War Stamps

Beyond the Horizon . . . Peace

We have come far this year along the road of battle. We know that the end is not yet, that higher hills must still be stormed, that the price of sacrifice must still be paid.

But we have come upward into the light. Our fighting men are driving back the enemy. Our ships and planes have scotched the menace of the submarine. Our cities are unseared.

And this country of ours has grown in power and resources, until it has become the greatest living force for good in the world.

Now, as we turn our faces toward the future, we can see the day of Victory dawning somewhere there, beyond the horizon.

We can go forward confident in the knowledge of our strength, the strength of millions of young men in arms, of mighty armadas of the air and the sea, of millions of workers producing unceasingly the machines and munitions that make our Victory sure.

We can go forward knowing that no nation has ever possessed so rich an endowment of materials, of skill and equipment; no nation has ever owned so great a reservoir of wealth, or so vast a pool of war-deferred demands for all the products that make up the American way of life.

As we turn our faces toward a new year . . . as we go on here at Kelvinator creating more and more weapons for Victory . . . as all of us at home carry on our portion of the fight . . .

Let us resolve to give, to the utmost of our power and means, to the men who fight for us across the seas.

Let us resolve to plan, now, to use wisely all the resources that this nation holds, to build enduringly the better life that is to come . . .

The life of a nation founded upon the dignity and honor of the individual, upon his right to a free and full opportunity to grow and to be useful to his fellow men . . .

This is the life for which our men have fought and bled . . .

This is the life they must find when they come back with peace—the peace that lies there, ahead, beyond the horizon.

The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for High Achievement in War Production.

NEW LOW-PRICED Permaflector 200 WATT FLOODLIGHT!

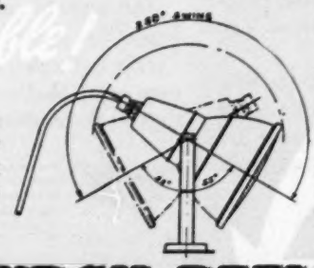
PERMAFLECTOR ENCLOSED FLOODLIGHT ST-200 FOR 200-WATT INCANDESCENT

Powerful beam of light from a standard 200-watt lamp! Offers higher priced mechanical and performance features at low cost. Built to "take it", ST-200 is ideal for service on power shovels, bulldozers, trucks and cranes; completely adjustable

SHOCK and WEATHER-PROOFED

Silver-mirrored glass PERMAFLECTOR; housed in corrosion-resistant sheet steel; convex, stippled, heat-resisting, 8⅜" lens; porcelain socket; weatherproof cord grip fitting. 12½" high overall; weighs only 6½ lbs.

Adjustable! Data!



250° swing vertically, 360° horizontally, by adjusting wing nuts on bracket and base.

200-watt PS-30 Incandescent Lamp

Beam spread	50°
Overall spread	145°
Lumen output	2545
Beam candlepower	7460

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING EQUIPMENT AND THE FAMOUS Permaflectors

OLIVER BLDG. PITTSBURGH, PENNA.

Please rush complete data on small-wattage PERMAFLECTOR Floodlight ST-200 — *BW 12-43*

NAME .....

ADDRESS .....

CITY ..... STATE .....

toasters, not to mention the long li of other appliances.

A careful analysis of the results ob tained by dealers discloses five sig nificant facts:

First, people will part with thei idle appliances providing it is eas for them to do so. Odd as it may seem, many people are not interested in the amount they are to be paid for their old appliances. A large number of dealers report that people are moved by a sense of patriotic duty. This indicates that a "help your neighbor" appeal is an effective means of obtaining idle appliances.

Second, the "Swap Your Old Ap pliances for War Stamps" Plan pro vides a substantial profit to the dealer who invests in the program. Few, if any, dealers made a profit in the first two months, but after that time the number of successful dealers has been increasing every week. Let's examine a few individual cases:

Dealer A

Invested $1,830 in war stamps, part and labor and received appliances with a salable value of $3,420. Here is how he arrived at these figures:

	Appliance Recovered		
	Refrigerator	Washer	Hand le
Cost in stamps.....	$20.00	$10.00	$0.2
Labor and parts.....	20.00	10.00	1.0
Total cost	40.00	20.00	1.2
Sales price	60.00	42.50	3.0
Unit profit	20.00	22.50	1.7
Number of units....	18	48	10
Total profit	$360.00	$1,080.00	$150.0

Total profit on all three items.....$1,590.0

Dealer B

Invested $896.48 in the "Swap Your O Appliances for War Stamps" Plan, in cluding cost of printing and distributi of two sets of handbills, war stamps pa out for 320 appliances, labor and par for these old appliances. When sold the 320 appliances brought $2,250, providi a profit of $1,353.52.

Dealer C

Swapped War Stamps for 143 items, which 127 were resalable. The cost these appliances (including War Stamp labor and parts) totaled $208.25. Of th 127 items 121 pieces have been dispos of at a total sales price of $669.25, or profit of $461.

At first glance this "Swap Yo Old Appliances for War Stamps" business looks like a gold mine. But it isn't. You must deduct general overhead expenses and remember that every customer that is sold must re main satisfied, even though he pur chased a piece of used equipment. "Swap Your Old Appliances for War Stamps" business is, however, good business for a dealer who works hard to get it.

Third, war workers appreciate th

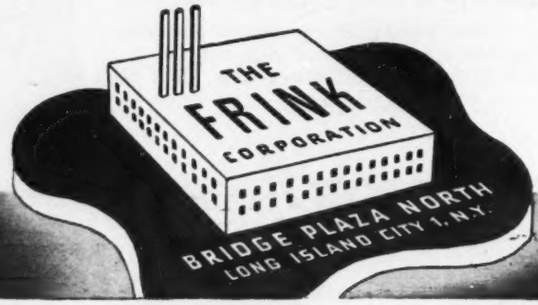
Their *FRINK-SHEATHED SUPERCHARGERS* are the answer, Fritz!

Newest fighter planes of the U. S. Army Air Forces are equipped with turbo-superchargers that enable them to outclimb Axis planes in combat. Attacking their adversaries from above, our pilots have the advantage that often means the difference between victory and defeat.

A vital part for these all-important superchargers is made by The Frink Corporation. The name Frink, though a relatively new name in the aircraft field, is an old and familiar one in the lighting industry. For 86 years Frink has meant expert engineering of lighting installations and precision manufacturing of lighting equipment. A pioneer in Fluorescent illumination, The Frink Corporation developed LINOLITE, the famous "engineered for vision" Fluorescent equipment, installations of which are giving such efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink, together with other leading manufacturers, is heavily engaged in making implements of war. Tomorrow Frink will resume the high quality engineering and manufacturing of lighting equipment which have gained an enviable reputation for its products in the lighting industry.

"LIGHTING SINCE 1857"



Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

"AMERICAN"

Now Working for Victory . . .

Is Also Planning for "V" Day

OUR military leaders have had to develop equipment for the desert, the mountain, the jungle—equipment peculiarly adapted to each condition. But when it came to mobile equipment for the Signal Corps they found in "American's" Telephone Maintenance Bodies built-in adaptability to meet their most severe requirements.

And the reason—"American" equipment is the result of long years of research, and practical field experience. It's planned equipment designed and built to meet normal and abnormal working needs and demands.

Today while working at top speed to fill government orders "American" is planning for the Peace. Thinking ahead so that you may have a more complete line of mobile construction and maintenance equipment. Equipment that will mean more in the way of economy, comfort and service.

All these things, however, cannot happen the day the war ends. It will take time for the change-over. "American", however, will be ready to deliver to you, just as fast as chassis are available, equipment of the same type as made before the war.

Always alert for new trends, "American" Engineers have their sights set for high marks. In order to attain this ideal they invite your suggestions.

Some Reasons Why "Americans" Are TOPS:—

Correct Design • Superior Quality Construction • Comfort • Convenience • Safety • Endurance • Low Operating Cost • Fine Appearance

THE American COACH & BODY CO.

PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

service. Dealers report long waiting lists of customers who are anxious to obtain reconditioned appliances. These people greatly appreciate any assistance and will remember a wartime service when the peacetime comes.

Fourth, "Swap Your Old Appliances for War Stamps" Plan increases service business. More than 90 percent of the dealers report that their repair business increased as a result of the "Swap Your Old Appliances for War Stamps" Program. Some have increased their repair business as much as 50 percent.

Fifth, "Swap Your Old Appliances for War Stamps" Plan provides reclaimed parts. Generally speaking, dealers have not reclaimed a large volume of repair parts from swapped appliances. However, it is estimated that approximately 7 to 10 percent of the appliances turned in are classified as equipment yielding salvage parts.

In conclusion, a "Swap Your Old Appliances for War Stamps" Plan is a profitable business and a worthwhile service to the public when and if the electrical dealer wishes to make an investment and digs out the old stuff in the same energetic manner that he dug out sales of new appliances before Pearl Harbor.

•

Advertising and Employee Relations

Wanting to find out how his company compared with others as regards advertising and employee relations activities, L. A. Brettner, advertising manager of the United Illuminating Company, New Haven, Conn., sent out queries to 50 utilities and got back 41 replies. Here is a summary of the information he received:

1. Size of advertising department normal

Under 100,000 meters (small).
3.9 persons average. Top— 8; Low—
100,000 to 400,000 (medium).
5.6 persons average. Top—12; Low—
Over 400,000 (large).
7.7 persons average. Top— 8; Low—

2. Have you any advertising agency tie-up?

(a) No—21 companies (51.2 percent).
Yes—20 companies (48.8 per cent).

(*Continued on page 12*

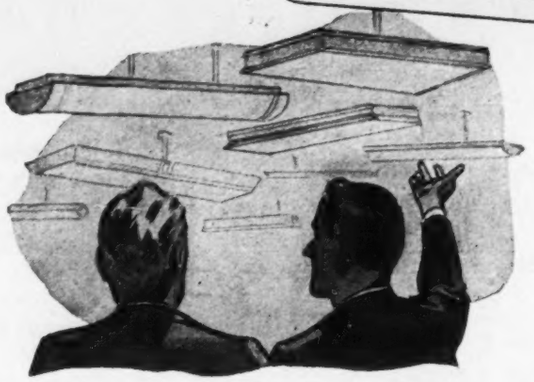
Again . . .

COMMERCIAL

lighting units that bear the label

FLEUR·O·LIER

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
E·T·L
E·T·L



(as authorized by WPB Order L-78, Revised)

AFTER December 1st, 1943, "commercial" fluorescent lighting fixtures bearing the famous FLEUR-O-LIER Certification Label will again be manufactured and made available for "essential" uses. Fixtures of this type are particularly suited to such locations as factory drafting rooms and offices, hospitals and various public institutions.

Many of the leading fixture makers participating in the FLEUR-O-LIER program will manufacture these units, which gives you a wider variety of sizes and designs. These new FLEUR-O-LIERS will combine the best features of pre-war equipment, plus improvements developed to help the war effort. And all will conform to WPB Limitation orders in the use of critical materials.

You can depend on these units, because like all fixtures labelled FLEUR-O-LIER, they are CHECKED and CERTIFIED by impartial experts—Electrical Testing Laboratories, Inc., of New York. They all meet rigid FLEUR-O-LIER specifications for Electrical, Mechanical and Lighting Excellence.

Commercial FLEUR-O-LIERS are available under the terms of L-78, CMP Reg. 5 and other WPB orders. FLEUR-O-LIER MANUFACTURERS, 2126-12 Keith Bldg., Cleveland 15, Ohio.

FLEUR·O·LIER *Manufacturers*

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

..."BUSS Fuses have kept our Cupola Blower Operating without a Needless Shutdown

...formerly we had an average of two outages per month,"

Says

ELECTRICAL MAINTENANCE SUPERINTENDENT

KARL MOEHLMAN

of Gisholt Machine Co., Madison, Wisconsin

"From a production standpoint," continues Mr. Moehlman, "probably the most important circuit in our plant is for a 50 horsepower, 220 volt, 3-phase motor operating a cupola blower. This blower simply *must not* fail, otherwise serious production loss occurs, involving damage to critical material.

"This particular circuit was blowing fuses at an average rate of twice a month, until we switched to BUSS Super-Lag fuses more than six months ago. Since the change, not a single fuse has been blown."

Why BUSS Fuses Don't Blow Needlessly

10 FEATURES in the design of the FUSE-CASE help make it possible. . . .

and

The SUPER-LAG development in the FUSE-LINK completes the job.

BUSS

Can Mr. Moehlman's experience at Gisholt suggest to you a way to eliminate needless production shutdowns due to fuses opening needlessly? His experience is like that of many others who have found that the long time-lag of BUSS Super-Lag fuses prevent needless shutdowns due to harmless overloads. Yet these fuses give you the protection you need when serious trouble occurs.

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Here is why BUSS fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating, which causes fuses to blow needlessly, is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a long time-lag so that unusually heavy starting current or other harmless overloads will not cause the fuse to blow.

How to solve the "shutdown" problem

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO., University at Jefferson, St. Louis 7, Mo.
Division McGraw Electric Company

Super-Lag FUSES

SOLD THROUGH WHOLESALERS

Vacu-Break SAFETY SWITCHES. Streamlined, completely enclosed. Capacities: 30 Amp. to 600 Amp. inclusive; 2, 3, and 4 Pole, 600 Volts or less.

Vacu-Break COMPACT TYPE SWITCHBOARDS. Wall mounted, standardized unit sections, extremely flexible. Capacities: 2 and 3 Pole, 30 Amp. to 600 Amp. inclusive; 600 Volts or less; or 4 Pole solid neutral 230 Volts, A.C. Horsepower rated.

Vacu-Break BUS PLUGS for use on BullDog BUStribution DUCT. Fusible or non-fusible, quick make and break, horsepower rated. Capacities: 2 or 3 Pole, 30 Amp. to 600 Amp. inclusive; 600 Volts or less; or 4 Pole solid neutral 230 Volts, A.C.

BULLDOG *Vacu-Break* SWITCH PRINCIPLE *with "Clampmatic" contacts*

No electrical distribution system can be any better than its circuit protection devices. That's why BullDog has extended its famous Vacu-Break Safety Switch principle, with "Clampmatic" contacts, to cover not only individual safety switches, but panelboards, switchboards and bus plugs as well.

Now you are assured of faster, tighter closing of switching devices — of quicker, smoother operation — all along the distribution line.

The secret of tighter closing, the smoother operation, of "Clampmatic" contacts, lies in the wedging action of the movable contact "slug" against the beveled spring prongs of the stationary contact.

Ask your BullDog representative to show you a cut-away "Clampmatic" demonstrator. You won't believe, until you actually try it yourself, how tight the contacts are when closed, how smooth and easy the operation is.

After you try it, why not specify "Vacu-Break Clampmatic" for all your distribution devices whether safety switches, panelboards, switchboards or bus plugs.

BULLDOG *"Clampmatic"* PRINCIPLE OF *Vacu-Break* SAFETY SWITCH CONTACTS

Movement to OFF is speeded by release of static energy in clamping spring.

Formed bakelite cover (arcing chamber) removed from switch head to show action.

Instant, positive pressure contact caused by wedging action of moving contact when operating to ON position.

Full ON position. Moving contact now fits tightly between stationary Line and Load contacts under full clamping pressure of the spring.

BULLDOG ELECTRIC PRODUCTS CO.

Box 177, R. Pk. Annex Detroit 32, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems — FOR LIGHT AND POWER.

BUY MORE WAR BONDS

(b) If so, how much?
All advertising?
Yes—9 companies (45 per cent)
Part?
Yes—8 companies (40 per cent)
Purely advisory.
3 companies (15 per cent)

3. Your normal advertising budget is what percent of gross revenue?

Small Companies (average) 0.6 percent
Top—1 per cent; Low—0.30
Medium Companies (average) 0.9 percent
Top—3 per cent; Low—0.30
Large Companies (average) 0.6 percent
Top—1 per cent; Low 0.16

4. Due to the times, your advertising budget has

A. Been cut by
Eleven companies (28.9 per cent) reported a cut in their advertising budgets this year. The average is 33 per cent.
B. Remained normal
Fourteen companies (36.8 per cent) reported a normal budget.
C. Been increased
Thirteen companies (34.2 per cent) reported an increase. Average increase 20 per cent.
There were only 38 companies which answered this question.

5. Has your company an employee education program?

(a) Yes—21 companies (51.2 per cent)
No—20 companies (48.8 per cent)
(b) If so, it includes
1. Lectures; nine companies
2. Pamphlets regularly given out; 11 companies,
3. Book on company for new employees; 15 companies.
4. Other—several companies reported training classes; posters, group meetings, etc. Some companies were not specific about their training programs.

6. Has your company ever made a survey on public relations among its employees?

Yes—three companies.
No—35 companies.
Three companies did not answer.

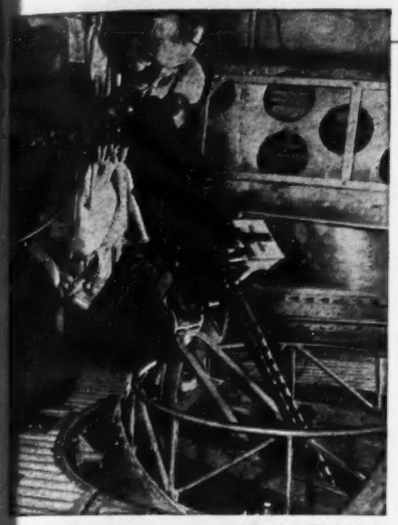
7. Has there ever been a public opinion survey on your company through your customers?

(a) No—17 companies (44.7 per cent)
Yes—21 companies (55.3 per cent)
(b) If so, who made the survey
Company—Eight companies (39 per cent).
Outside agency—13 companies (61 per cent).
(c) Survey made in 19..?
The earliest survey reported was made in 1933; the latest in 1942.
(d) As a result of this survey, your company, in the opinion of its customers' rates
Good—14 companies (66 per cent)
Fair— 7 companies (33 per cent)
(e) Has the survey ever been used as basis for customer relations?
Yes.

A quick picture of

FRIGIDAIRE'S WARTIME PROGRAM

and what it means to Frigidaire Dealers



Official O. W. I. photo

ARMS FOR VICTORY

Victory Is Our Business. Building weapons of war has been and continues to be our first and most important responsibility.

We take pride in the recognition we have received for the job being done in Frigidaire's four war production plants.

In the Army-Navy "E" Flag and star awarded to us for excellence, and the Army Air Force "A" rating we have received.

Today more men and women are employed in Frigidaire plants than ever before in our history. And our war production is still mounting.

Only when the whole story of Frigidaire's planning and production can be told will the full significance of the statement "Victory is our business" be apparent.

What This Means to Frigidaire Dealers

Wartime accomplishments have brought us new knowledge and skills that will benefit the Frigidaire dealer when we return to peacetime production, and surely Frigidaire's wartime record will enhance the value of the Frigidaire name.

KEEPING 'EM RUNNING

Victory Is Our Business on the home front, too. And keeping the millions of Frigidaire products operating efficiently is another important responsibility. For today the nation's food supply must be protected and conserved as never before.

We're proud of the dependable way in which Frigidaire household appliances and commercial equipment are serving their users.

Proud, too, of the Frigidaire dealers and service men who are guarding this record of dependability during these trying times.

We are constantly helping this service organization in every way we can. By supplying vital parts; by providing training aids; and by holding frequent factory and district-conducted schools to help dealers train service men.

What This Means to Frigidaire Dealers

Frigidaire service today is building a backlog of customer satisfaction and good will that will mean increased sales for Frigidaire Dealers after the war. Right now, this service business is helping Frigidaire dealers maintain income during a critical period.

HELPING THE USER

Victory Is Our Business. The proper use and care of the nation's 20 million household refrigerators is vitally important to the war effort on the home front.

Frigidaire accepted the responsibility of providing needed wartime information . . . not only to Frigidaire users, *but to every owner of a refrigerator.*

Month after month Frigidaire's advertising messages in leading magazines have told housewives how to make their refrigerators serve better and last longer.

Similar help has been given in Frigidaire's 36-page WARTIME SUGGESTIONS booklet. More than six and a half million copies have been distributed . . . *most of them by Frigidaire Dealers.*

Home economists, group leaders and other organizations were given helpful information for their use. Hundreds of users, home economists, dealers and others have sent us unsolicited letters endorsing the program's aims and purpose.

What This Means to Frigidaire Dealers

This comprehensive program is keeping the name Frigidaire before the public in a way that will be favorably remembered. And it is also helping Frigidaire dealers maintain identification with Frigidaire and build good will for themselves in their communities.

PLANNING FOR THE FUTURE

Victory Is Our Business so we have little time for future planning. But, every moment we can spare without interfering in any way with war work is devoted to this important subject.

Every Frigidaire dealer, large or small, has been given an opportunity to express his views and desires on every phase of our post war business. These views and opinions are being carefully considered and will play an important part in the planning of our peacetime selling activities.

What This Means to Frigidaire Dealers

After Victory there will be more and better Frigidaire products for more people. Frigidaire dealers will have the right merchandise, the right selling tools and every support they need to keep on top. Frigidaire's 25-year record of leadership is a blueprint of the future.

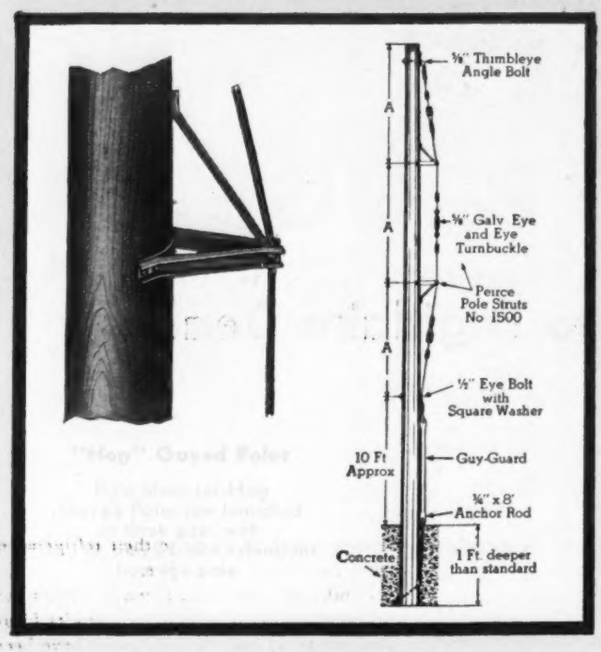
For Excellence in War Production

Listen to GENERAL MOTORS SYMPHONY OF THE AIR; Every Sunday Afternoon, NBC Network

FRIGIDAIRE Division of GENERAL MOTORS

Peacetime Builders of **HOME APPLIANCES · COMMERCIAL REFRIGERATION · AIR CONDITIONERS**

HUBBARD HARDWARE

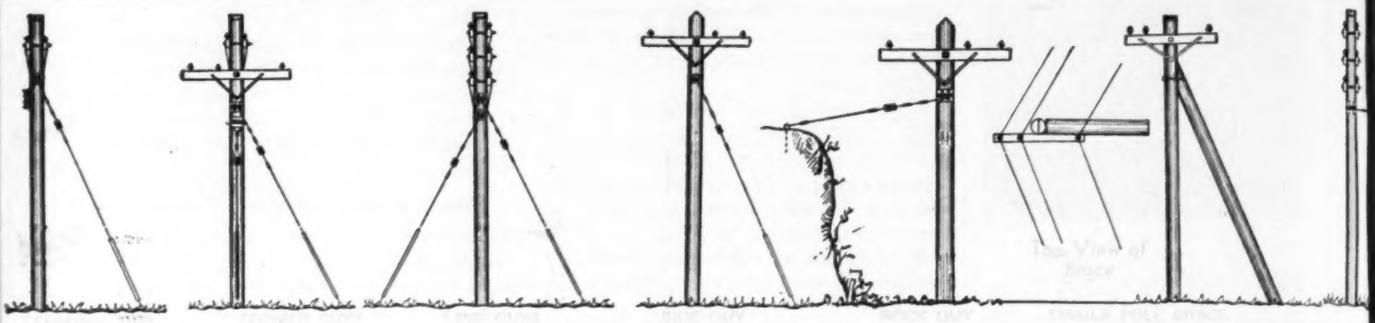


No. 6012
Angle Thimbleye Bolt
Furnished in sizes from ⅝-inch to 1-inch Diam. and 8-inches to 18-inches in length.

←For ½" Lags.
←For ⅝" Thru-Bolt
←For Guy Bolts up to 1 1/16" Diam.

No. 8891 Load Plate
Furnished in several sizes and styles, curved and flat.

No. 7510 Thimbleye
Sizes for ½- ⅝- ¾- and 1-in bolts, Double and Triple e



Large Eye Opening→ for Insertion of Bar.

←High Carbon Steel Rod.
←Drop Forged Wings 2¼" to 10" Diam.

No. 7528
Steelwing Anchor
1½ Ft. to 8 Ft. Lengths.

←Thimbleye Threaded Anchor Rod.

No. 6316
Made in ½- ⅝- ¾- and 1-inch Diam. Lengths from 5 Ft. to 10 Ft.

←Tapered Guy Protector.

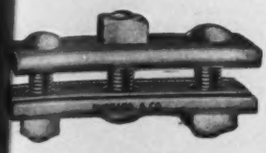
No. 7658
7 Ft. and 8 Ft. Lengths Several Styles.

"Hang the Load on Hubbard Hardware"

FOR ALL TYPES OF GUYS

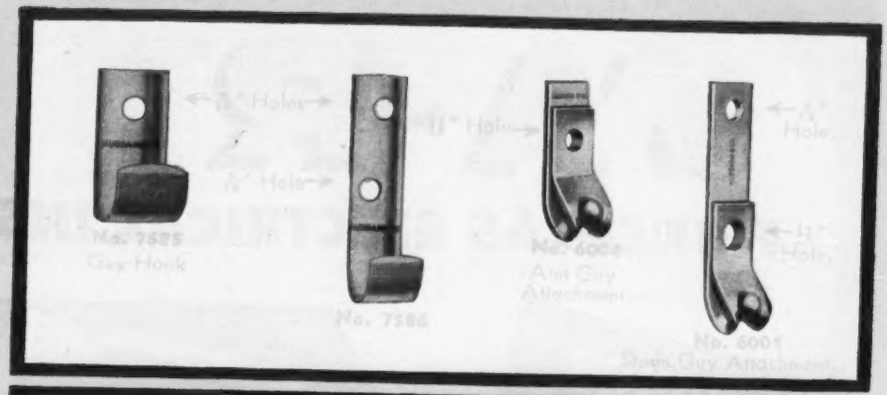
No. 7575 Strain Plate

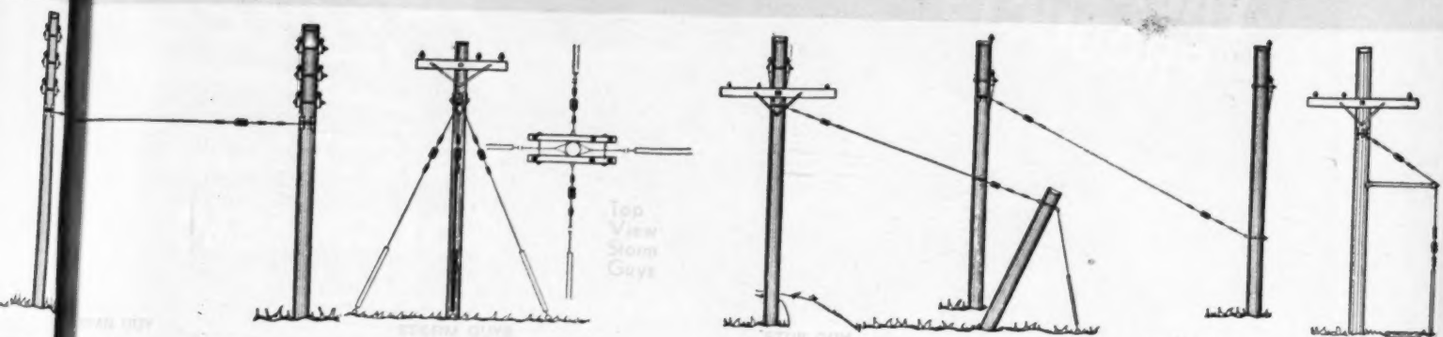
Styles are plain and for Moulding. Also with Guy Hooks attached.

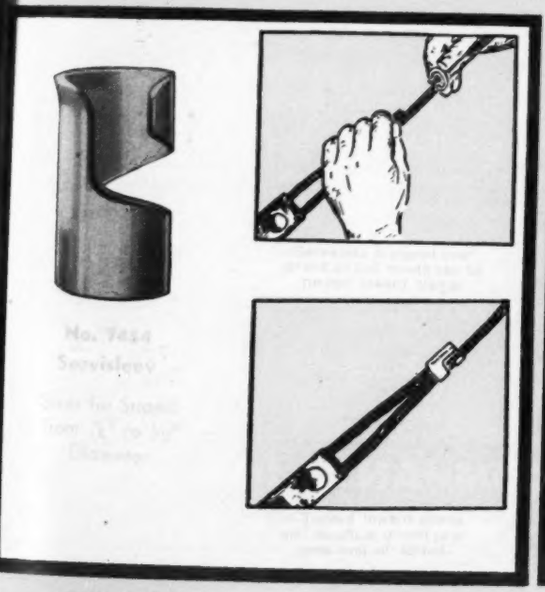


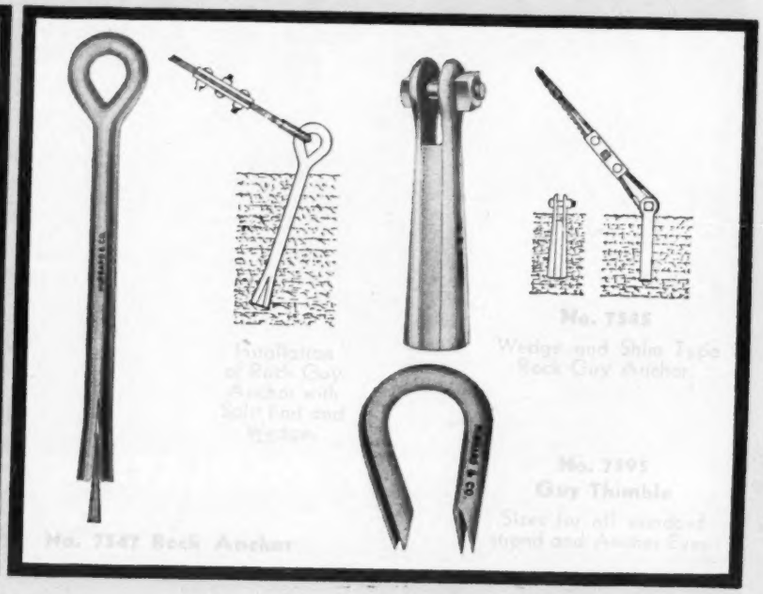
No. 7461 Guy Clamp

One, two, three and four-bolt styles for all standard strand.









HUBBARD

HUBBARD AND COMPANY

PITTSBURGH . . OAKLAND . . . CALIFORNIA . . CHICAGO

M-R

FIBREGLAS ELECTRICAL INSULATIONS

TUBINGS
TAPES
CLOTHS
AND
FABRICATED
PRODUCTS

Protect

ELECTRICAL EQUIPMENT

The destructive forces that play havoc with ordinary electrical insulation have little or no effect on M-R Fibreglas insulations . . . Overloading . . . Extreme High or Low Temperatures . . . Moisture . . . Corrosive Acids, Fumes, or Vapors . . . Oils . . . Greases . . . Dust or Dirt Don't Affect M-R Fibreglas inorganic Electrical Insulations.

M-R Fibreglas Insulations have an amazing background of use, throughout industry, featured with fewer breakdowns, less maintenance, elimination of waste, savings in labor and materials and proof of their standing as the optimum in Electrical Insulation Protection.

WRITE TODAY FOR DETAILED INFORMATION

M-R
FOR 54 YEARS
THE ELECTRICAL
INSULATION
HEADQUARTERS

MITCHELL-RAND INSULATION COMPANY, INC.

51 MURRAY STREET COrtlandt 7-9264 **NEW YORK 7, N. Y.**

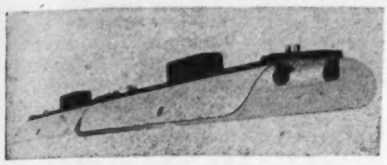
A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds
Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types
Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

NEW EQUIPMENT

Luminaire

Designed for continuous strip installation, luminaire has one-piece double-length hood and two full-size reflectors. Hood is



"Type FNC" luminaire; for use with four or six 40-watt or four 100-watt Mazda F lamps. **Westinghouse Lighting Division**, Edgewater Park, Cleveland, Ohio.

fabricated from sheet steel with ballasts, lamp holders and starter sockets mounted and wired as part of the channel assembly. Non-metallic reflectors have a polymerized finish which provides a reflection factor of 85 percent or more. Mounting arrangements are available for any application.

•

Circuit Breakers

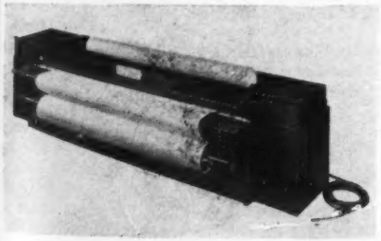
"Type LG" inclosed air circuit breaker; current ratings from 2,000 to 10,000 amp.; voltage ratings, 600 a.c. and 250 d.c. **I-T-E Circuit Breaker Co.**, 19th and Hamilton Sts., Philadelphia, Pa.

For public utility or heavy industrial service air circuit breakers are available in individual inclosures of heavy-gage, bonderized sheet steel and can be supplied for either indoor or outdoor service. In either type the circuit breaker may be opened or closed without opening the inclosure. Large doors are provided at front and rear and connecting cables may enter the inclosure at the top, bottom or sides.

•

Printers

Table-type printer has Cooper-Hewitt mercury-vapor tube lamps mounted horizontally and is designed to produce blueprints or direct process black and white prints in any lengths at a speed up to 42 in. per minute. Continuous rolls or as many as five 8½x11-in. cut sheets at one time may be fed into the machine.



Models "B-1" (single-tube) and "B-2" (two-tube) printer; takes tracings, drawings or printed matter up to 44 in. wide. **Peck & Harvey**, 4327 Addison St., Chicago, Ill.

•

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Ballast for use with cold-cathode fluorescent tubes incorporates a transformer, two reactors and a capacitor. Tube connections are made in multiple and operation is such that stroboscopic effect is reduced to a minimum, it is claimed. Tubes light instantly, without use of starter. Manufacturer states that the power factor of the ballast

Ballast; operates on 115-volt a.c.; size, 2½ x 3⅛ x 9½ in.; weight, 9 lb.; operates two 40-watt tubes, power consumption, 105 watts. **Jefferson Electric Co.**, Bellwood, Ill.

is approximately unity and that lighting of the tubes is accomplished on line voltage as low as 100 volts without flicker.

•

Resistance Wire

"Wyndaloy 17-3" precision resistance wire; standard sizes in ribbon, strip and wire. **Wyndale Mfg. Corp.**, 1203 Cornell Ave., Indianapolis, Ind.

Resistance wire for use in meters and instruments is a silver base composition containing manganese and tin. The alloy can be produced with a zero temperature coefficient of resistivity over a temperature range extending from 0 to 200 deg. C. The manufacturer gives other properties as follows: Strength, 60,000-80,000 psi.; density, 9.12 grams per centimeter cubed; in the cold worked condition, resistivity of 58 microhms per centimeter cubed; a negative temperature coefficient of minus 0.000105; elongation, approximately 1 percent; more brittle than "Wyndaloy 10-8" and must be carefully handled.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Mercury Searchlight

New high-intensity searchlight, the smallest size of which is said to provide four times the candlepower of an incandescent unit of the same size, has an air-cooled

High-intensity air-conditioned mercury searchlight; sizes, 12, 18 and 24-in. diameters; maximum candlepower range from 7,500,000 for 12-in. unit to 32,000,000 for 24-in. unit; light source, capillary-type 900-watt mercury lamp. **General Electric Co.**, Schenectady, N. Y.

lamp for operation in all types of weather. Depending on type of mounting, pilot house, low base, stanchion or high pedestal type, vertical movement is from 45-deg. depression to straight up vertically and 360 deg. rotation. An air compressor, an optional part of the searchlight, provides oil- and moisture-free air at 25 psi. at a rate of 6 c.f.m., and is driven by a ¾-hp. motor. Safety switch for opened door and pressure switch for air pressures are provided.

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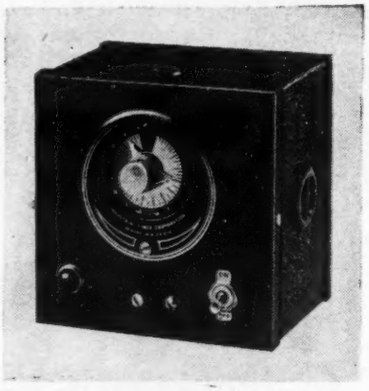
Timer

New signaling timer has slow-speed, self-starting synchronous motor, silver contacts and calibration dial. When pointer is manually set a pilot light circuit is closed, indicating that the time interval has started. Moving pointer revolves to zero, showing exact elapsed time. When interval is completed audible alarm sounds and pilot light goes out. Buzzer continues to sound until switch on timer is snapped to off position or timing interval is again started.



"Series S" signaling timer; maximum intervals 1 minute to three hours; 115 to 230 volts, 25, 50 or 60 cycles. **Industrial Timer Corp.**, 117 Edison Place, Newark, N. J.

M-R

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Impregnated Varnish Tubing
Insulating Varnishes of all types
Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

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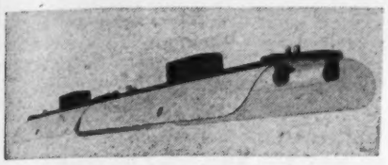

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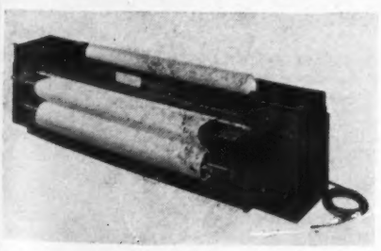

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5 YEARS EXTRA USE for 5¢ EXTRA COST!

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HARPER fastenings add years and years to the service life of products and equipment on which they are used . . . and do it at a trifling extra first cost. They insure your product against the ravages of rust and corrosion. They resist numerous acids and alkalies . . . ocean salt . . . tropic sweat. They save hours of time and labor required to replace rusted common steel bolts . . . prevent failure of vital equipment . . . keep production rolling . . . are repeatedly removable. In certain alloys they are non-magnetic and non-sparking. 4320 items in stock. Write for 96 page catalog in 4 colors.

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TECHNICAL LITERATUR

STANDARDS—"Feeder Voltage Regula Standards" contains all of the standar of a national character on the inducti type regulators of all ratings and voltag and the step-type regulators, 250 kva. a smaller, single phase, and 750 kva. a smaller, three phase, of all voltages. Copi of Publication No. 43-86 may be obtain from the National Electrical Manufacture Association, 155 East 44th St., New Yor N. Y.; price 75 cents per copy.

STANDARDS—The 1943 edition "A.S.T.M. Standards on Steel Piping M terials" is a compilation of 44 standards a 25 emergency alternate provisions that ha been issued by A.S.T.M. covering pip tubes, castings, forgings and bolting, a includes the austenite grain size classifi tion chart for steels. Copies can be o tained from American Society for Testi Materials, 260 South Broad St., Philade phia 2, Pa.; price $1.75 per copy.

STANDARDS—A new war standard "Fix Composition Resistors" covers one of t component parts which are suitable for u in communications and electronic equi ment, and which have nominal power r ings of not over five watts. It has been a proved for use by the U. S. Signal Cor and the U. S. Navy, Bureau of Ships, Rad Division. Copy may be had without charg for procurement purposes only, from t government agency concerned, or for t cents from the American Standards As ciation, 29 West 39th St., New York N. Y.

ELECTRONIC CONTROL—A 46-page boo let has six published articles on circui and operation of electronic controls for r sistance welding. Simplified circuit di grams are used liberally in explaining t fundamentals of the types of the respecti G.E. electronic controls. The publicati G E T—1170, entitled "Fundamentals Electronic Control for Resistance Welding is obtainable from General Electric Co Schenectady, N. Y.

PAINT SPRAYING—A wall chart of pai spraying rules showing how to save pai air, time, power, fuel, and equipment, re duce time lost because of sickness or a cident, and improve results, has been pu lished by the Eclipse Air Brush Co., 4 Park Ave., Newark 7, N. J.

LUCITE—Physical properties, tabulat data and curves on effect of heating, boi ing water treatment and dry oven trea ment of the molding powder are contain in a bulletin, "Heat-Resistant 'Lucit Methyl Methacrylate Resin Molding Pow der," available from Plastics Departmen E. I. du Pont de Nemours & Compan Arlington, N. J., when request is made o business letterhead.

METAL CHILLING—Designed to show ho to use sub-zero temperatures for cold trea ment of metals, a 24-page "Metal Chilli Data Book" contains a table showing th approximate shrinkage obtained for vario types of metals, conversion tables for har ness and temperature, a table for calcula ing the margin of safety factor required i hoop stresses, as well as numerous ca studies on the use of the Deepfreeze indu trial chilling equipment. Copy of the boo may be obtained from the Deepfreeze Di sion of Motor Products Corp., North Ch cago, Ill.

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Many leading companies and government agencies use Teco services. Upon request, Teco engineers have consulted with the engineers of the Army, Navy, and Maritime Commission, The Austin Company, Chas. T. Main, Inc., the Higgins Industries, Inc., and many others on the preparation of timber designs.

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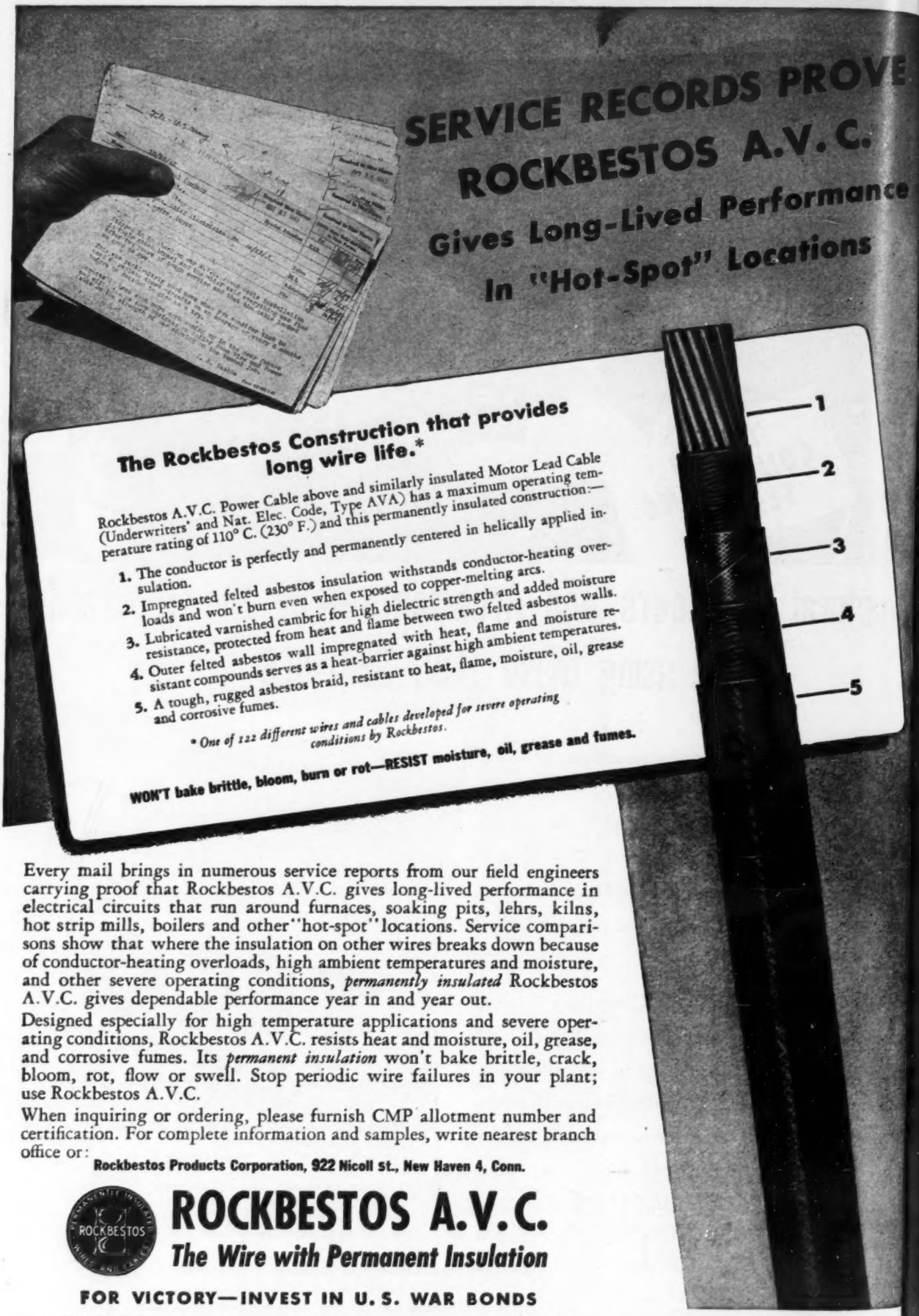
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Gives Long-Lived Performance
In "Hot-Spot" Locations
The Rockbestos Construction that provides long wire life.*
Rockbestos A.V.C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:—
1. The conductor is perfectly and permanently centered in helically applied insulation.
2. Impregnated felted asbestos insulation withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame between two felted asbestos walls.
4. Outer felted asbestos wall impregnated with heat, flame and moisture resistant compounds serves as a heat-barrier against high ambient temperatures.
5. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
* One of 122 different wires and cables developed for severe operating conditions by Rockbestos.
WON'T bake brittle, bloom, burn or rot—RESIST moisture, oil, grease and fumes.
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Every mail brings in numerous service reports from our field engineers carrying proof that Rockbestos A.V.C. gives long-lived performance in electrical circuits that run around furnaces, soaking pits, lehrs, kilns, hot strip mills, boilers and other "hot-spot" locations. Service comparisons show that where the insulation on other wires breaks down because of conductor-heating overloads, high ambient temperatures and moisture, and other severe operating conditions, *permanently insulated* Rockbestos A.V.C. gives dependable performance year in and year out.

Designed especially for high temperature applications and severe operating conditions, Rockbestos A.V.C. resists heat and moisture, oil, grease, and corrosive fumes. Its *permanent insulation* won't bake brittle, crack, bloom, rot, flow or swell. Stop periodic wire failures in your plant; use Rockbestos A.V.C.

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NEWS ABOUT PEOPLE

Plank Assumes Broader Duties in Delaware

H. H. Plank has been appointed assistant to vice-president and general manager of the Delaware Power & Light Co., Delaware Coach Co. and its subsidiaries with headquarters in Dover. Mr. Plank has spent part of his time with the Delaware utility during the past 18 months in the new-business department. In addition to his duties in the capacity of assistant to vice-president and general manager, he will be specifically in charge of all promotional activities, merchandising, power sales, advertising, rates, contracts and all

other activities incidental to the promotion of new business of all companies.

Mr. Plank is a graduate of Clarkson College and for a number of years has been associated with the U.G.I. Co. and its subsidiary companies in conjunction with the new-business activities of these companies.

•

▶ DENIS STAIRS, of Montreal, director-general of the defense projects construction branch of Department of Munitions, has been appointed deputy power controller, it was recently announced in an order-in-council published in Canadian war orders and regulations. Mr. Stairs, who is now located in Ottawa and who will remain there, is a director of Montreal Engineering, Ltd., and was chief engineer of that company prior to taking the Munitions Department position. He has had 30 years' engineering construction experience in North and South America.

•

H. A. Van Norman to Head Los Angeles Operations

Consolidation of the power and water bureau and appointment of H. A. Van Norman as chief engineer and general manager of the combined operations have been announced by the Los Angeles Department of Water and Power.

A veteran city employee and under the old set-up head of the Bureau of Water Works and Supply, Mr. Van Norman was for many years assistant to the late William Mulholland, "father" of the Los Angeles aqueduct, and is identified with construction of that project. He directed the Owens Valley Aqueduct maintenance and extension, including the recently completed 13-mile Mono Craters tunnel, which added a new watershed to the Owens Valley source. A native of Texas, he has lived most of his life in southern California.

H. C. Gardette, who headed the Bureau of Power and Light under the former operating plan, has been serving recently under an extension of his retirement period. Mr. Van Norman is scheduled to reach his retirement period soon, but it is expected that he, too, will continue to serve under a time extension.

•

▶ C. A. KITTREDGE, for the past 15 years Gadsden district manager of the Alabama Power Co., has retired from that position for reasons of health and W. M. WADE, superintendent of the southern division, has been named to succeed him. Before his assignment to the Gadsden district, in 1928, Mr. Kittredge spent several years as superintendent of the southern division. He will remain with the company in a consulting capacity. Mr. Kittredge was honored at a farewell gathering attended by forty of his associates.

John A. Roebling's Sons Promotes S. E. Yeaton

Stuart E. Yeaton, native of Seattle, Wash., and a graduate of the University of Washington, has been made manager of sales of the electrical wire and cable division of the John A. Roebling's Sons Co., Trenton, N. J.

Subsequent to his graduation from the university he was employed as a salesman in the Seattle branch from 1934 to 1941, at which time he was made assistant to W. G. Marks, president of the California Corporation of the Roebling Co. at San Francisco. In May, 1943, he was transferred to the main

S. E. Yeaton

office at Trenton as manager of sales of round, flat wire and specialties.

G. K. Hayes, who has represented the company as a salesman out of the Cleveland branch for several years, has been appointed assistant manager of that branch. Mr. Hayes is a graduate of the University of West Virginia and has been connected with the company since 1930.

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▶ O. F. FITZWATER, assistant treasurer and assistant secretary of the Indianapolis Power & Light Co., has been elected to membership in the Controllers Institute of America.

▶ JAMES B. HAWKINS has been appointed manager of the central division of Virginia Public Service Co., Alexandria. Mr. Hawkins will succeed RAYMOND HUNT, who has been assigned special duties with the general engineering department of the company. Both men will have headquarters in Charlottesville. A graduate of Virginia Polytechnic Institute, Mr. Hawkins spent one year in the test department of General Electric Co. in Schenectady. In 1926 he joined the Virginia Public Service organization as division engi-

Cable Protection UNDERGROUND *FOR* Plane Protection OVERHEAD

• Here at home and all over the world wherever Uncle Sam is carrying the war to the Axis, safe and efficient operation of United Nations airports is of the greatest military importance.

• Vital "nerve centers" of these airports are the cables and wires of their power, light and signal services. Engineers have found from experience that the safest place for complete cable protection is *underground*—housed in Orangeburg Conduits.

• Light weight, ease of handling and workability make possible rapid installation. No scoring or damaging of cable sheath when pulling. No corrosion of sheath at points of contact. No infiltration of corrosive elements at any point of line. Tapered sleeve joint provides tight joints with perfect alignment of raceways.

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for installation with concrete encasement

ORANGEBURG NOCRETE CONDUIT
for installation without concrete encasement

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ORANGEBURG WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

neer for the western division and ma
ager of the Clifton Forge district, M
Hawkins was transferred to Alexandr
in 1940 as superintendent of operation
for the northern division, the positi
he held until his recent transfer
Charlottesville as central division ma
ager. In his new position Mr. Hu
will specialize in the preparation of th
company construction budgets and,
addition, will be assigned special duti
which have to do with wartime oper
tions as well as post-war plans.

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H. C. Zinsmeister Heads Pittsburgh Reflecto

H. C. Zinsmeister has been electe
president of the Pittsburgh Reflecto
Co., Pittsburgh, Pa., succeeding E. W
Simons, who has retired.

Mr. Zinsmeister joined Pittsburgh Re

flector Co. in 1934 and served as audito
until 1940, when he was elected treas
urer. In addition he has been affiliate
with Sutton Engineering Co. as consul
ing auditor for the past 20 years.

He is well known in the lighting in
dustry and in accounting and banki
circles in the Pittsburgh district.

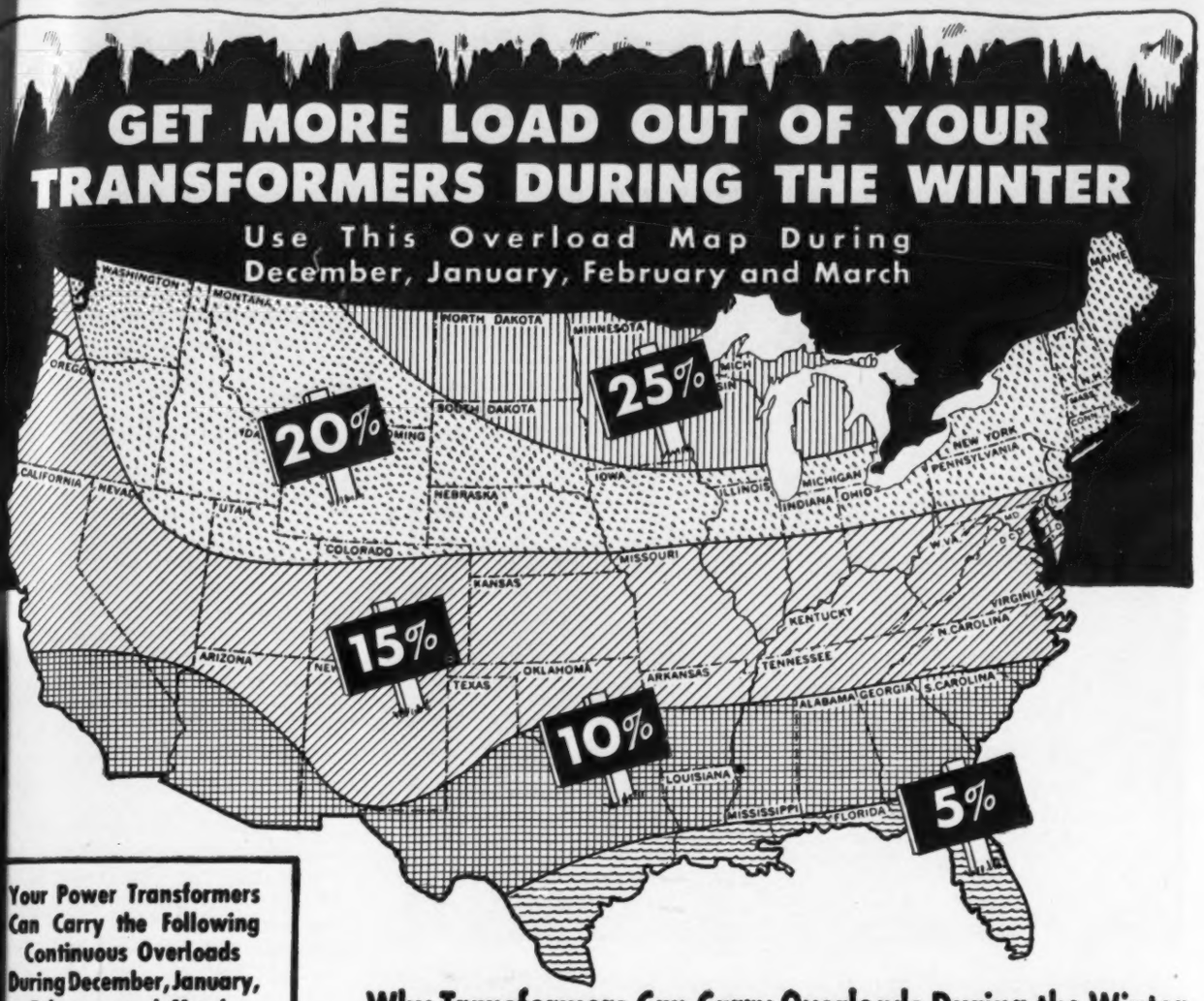
•

► Dr. George W. Allison, prominent
connected with the electrical indust
for a number of years, has becom
identified with the economic develo
ment and research department recent
organized by the Puget Sound Power
Light Co. For many years connecte
with the Edison Electric Institute, D
Allison is nationally known for h
activities in the "Better Light" and th
"National Cookery Council" program
as a representative of E.E.I.

► Clifford E. Plummer has been a
pointed chief engineer for the Modes
Irrigation District (California) to su
ceed Neil M. Cecil, resigned. Sin

GET MORE LOAD OUT OF YOUR TRANSFORMERS DURING THE WINTER

Use This Overload Map During
December, January, February and March



Your Power Transformers Can Carry the Following Continuous Overloads During December, January, February and March

Temperature Zone	Permissible Continuous Overloads
	25%
	20%
	15%
	10%
	5%

The above data applies to all Pennsylvania Oil and Askarel self-cooled transformers—55° C Rise.

For Transformers with Forced Air Cooling

Apply ¾ of the above percentages to the forced-air cooled rating.

Why Transformers Can Carry Overloads During the Winter

● Due to low ambient temperatures during the winter, transformers can carry more load than their nameplate rating. The transformer standards of the American Standards Association recommend that the continuous KVA loading for oil-immersed, self-cooled transformers may be increased one per cent for each degree that the daily average temperature is below 30° Centigrade.

Based on records of the U. S. Weather Bureau over a period of years, equivalent ambient temperatures were calculated for the 4 month winter period for representative locations throughout the country.

The equivalent ambient is the temperature which, if maintained constantly, would result in the same aging as that occurring under the actual ambient temperatures throughout the period. The equivalent ambient temperatures were used to calculate the permissible continuous overload capability for various temperature zones.

The continuous overloads indicated by the map and table may be safely carried during the 4 winter months because the operation of a transformer at low temperatures results in a slower aging of insulation which compensates for faster aging of insulation during operation at higher temperatures.

Pennsylvania TRANSFORMERS

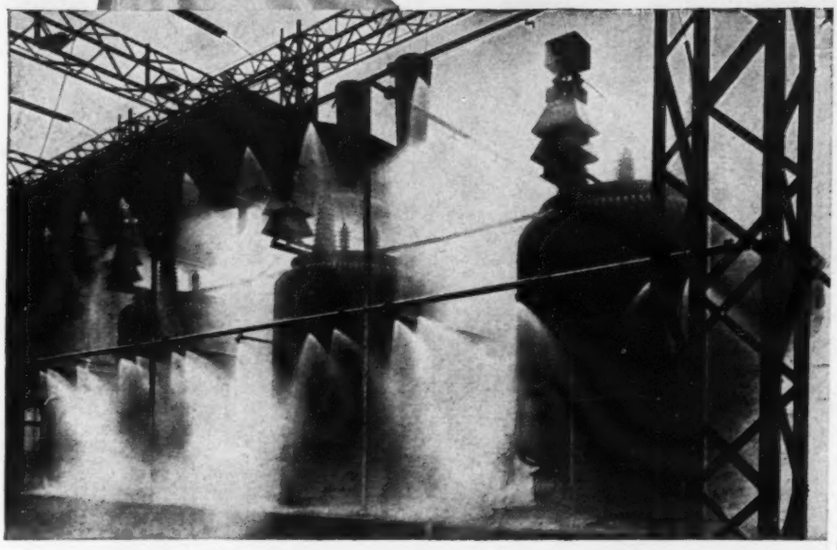
Pennsylvania
TRANSFORMER COMPANY
PITTSBURGH, PENNSYLVANIA

Reprints of This Page are Available Upon Request

WAR PRODUCTION

depends upon

a continuous POWER SUPPLY



Protect your oil-filled equipment from FIRE with a GRINNELL MULSIFYRE SYSTEM

MULSIFYRE SYSTEMS operate on the principle of mulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. A Mulsifyre System extinguishes fire in a few seconds and prevents reignition.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically and manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard . . . in transformers and other oil-filled electrical equipment.

Investigate this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of U. S. and Canada.

GRINNELL

MULSIFYRE SYSTEMS

For Production Protection

1936 Mr. Plummer had been the d trict's chief electrical engineer, a po tion which has been consolidated wi that of irrigation engineer. Before h association with Modesto Irrigation D trict he had been electrical foreman an electrical superintendent of the Turlo Irrigation District.

•

U. S. Rubber Assigns New Duties in Cable Grou

Harold J. MacDonald and Howar F. Johnson of the wire and cable depar ment of United States Rubber Co. hav been assigned to new positions—M MacDonald in charge of all jobbing wi the title of manager, jobbing sales; Mr Johnson manager of branch sales wi offices in New York City.

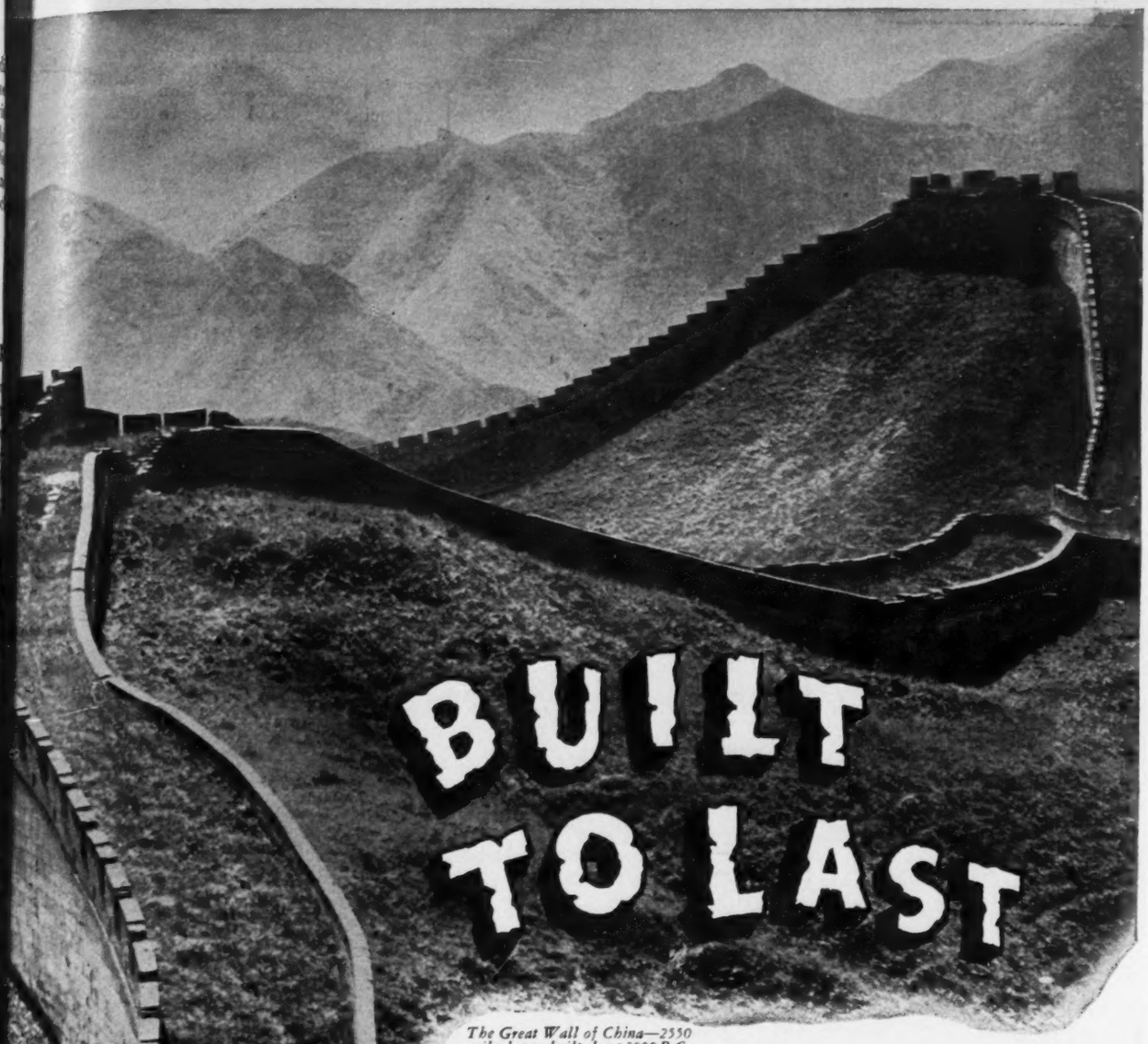
After receiving an honorable di charge from the U. S. Army, Mr. Mac Donald's first position with the com pany was at the Bristol plant in 192 He was promoted to New England sale manager with offices in Boston in 192 He held this position until 1938, whe he was promoted to eastern district sale manager of the wire and cable depar ment.

Mr. Johnson started with the com pany at the Bristol plant in 1922 imme diately after he was graduated fro Brown University, where he obtained hi engineering Sc. B. Promoted in 1932 t office manager, wire and cable depar ment, he held this position until 193 when he was elevated to the position o western district sales manager.

•

▶ GEORGE L. RIDEOUT, formerly as sistant to the personnel officer of th Puget Sound Power & Light Co., Se attle, has become affiliated with th economic development and research de partment, recently organized by th company and headed by Henry Krus (ELECTRICAL WORLD, November 15 page 145). Mr. Rideout, who is no assistant to Mr. Kruse, began his serv ice with Puget Power in 1930 and ha a wide and varied experience in th utility field. He previously worked i the company's advertising departmen as assistant to the advertising director

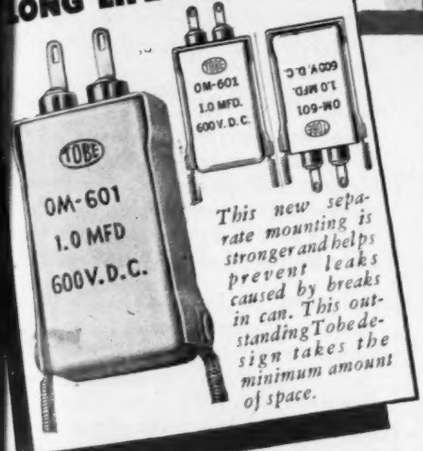
▶ WALTER L. HARRADEN, one of th General Electric Co.'s street lighting pioneers, has retired after 45 years service with the company. Well known in utility circles, Mr. Harraden is th co-inventor, with C. A. B. Halvorson, o the ornamental luminous arc lamp widely used for street lighting during 1914-20, and still operating on many business streets. Since 1916 he has been engaged in promotional activities in th company's lighting division at Schenec



The Great Wall of China—2550 miles long—built about 3000 B.C.

THROUGHOUT EVERY STEP of manufacture, long life is built into Tobe Capacitors. And before manufacture begins, Tobe engineers have shown great ingenuity in pioneering new and advanced designs. The original capacitor with hold-down bracket (Tobe OM-601) is shown below. It has many outstanding advantages over certain other types and shapes of capacitors. This new capacitor is strong, compact and space-saving and the new hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. Write us about your capacitor problems. They will have the best efforts of Tobe engineers.

LONG LIFE ASSURED



This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.

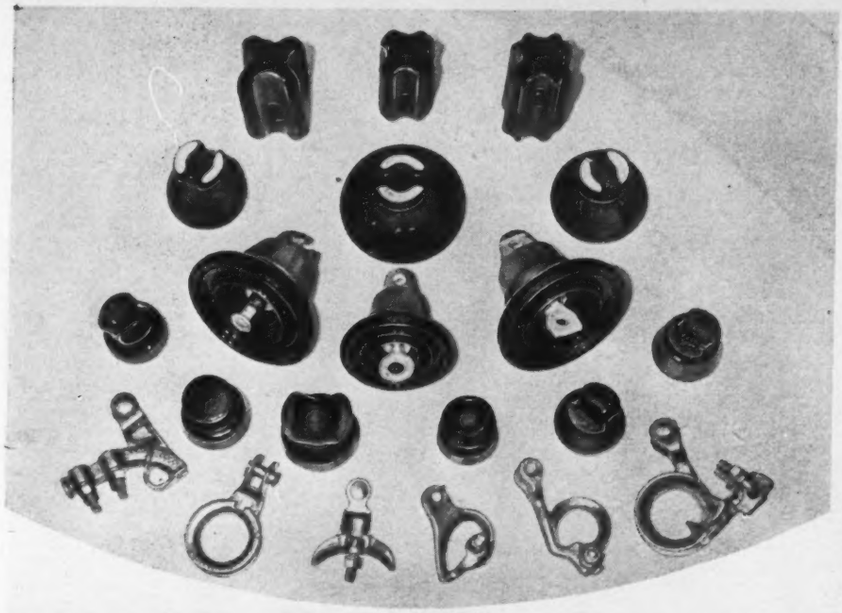
SPECIFICATIONS
TOBE OM-601 CAPACITORS

TYPE	OM
RATINGS .05 to 2.0 mfd. 600 V.D.C.	
.05 mfd. to 1.0 mfd. 1,000 V.D.C.	
STANDARD CAPACITY TOLERANCE . . .	10%
TEST VOLTAGE . . . Twice D.C. rating	
GROUND TEST . . . 2,500 Volts, D.C.	
OPERATING TEMPERATURE	55° F to 185° F
SHUNT RESISTANCE	
.05 to 0.1 mfd. 20,000 megohms.	
.25 to 0.5 mfd. 12,000 megohms.	
1.0 to 2.0 mfd. 12,000 megohms.	
POWER FACTOR	
At 1,000 cycles—.002 to .005	
CONTAINER SIZE	
Width 5/8", length 15/16", ht.	2 1/4"
MOUNTING HOLE CENTERS	1 1/2"

TOBE DEUTSCHMANN CORP. TOBE CANTON • MASSACHUSETTS

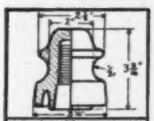
A small part in victory today

A BIG PART IN INDUSTRY TOMORROW

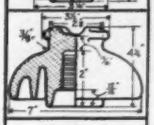


PINCO Distribution Line

Hardware and Insulators

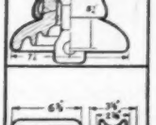


Pinco Pin Type Insulators for rated voltages up to 23 Kv. are available in eleven standard models. They give typical "right on the job" service during an exceptionally long life. Illustrated here are No. 62 with 6.6 Kv. rating and No. 367 with 23 Kv. rating.

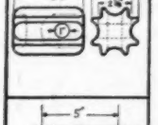


Pinco Suspension Type Insulators are limited by Government regulation to seven types Illustrated are No. 1510 with Flashover rating, Dry 60,000 V, Wet 35,000 V and No. 600 with Flashover Rating Dry 65,000 V and Wet 40,000 V Others up to 80,000 volts dry—60,000 volts wet. The No. 1925 is for fog or contaminated conditions.

Pinco Guy Strain Insulators are made by the Wet Plastic Porcelain Process. Various styles and capacities available for standard distribution line requirements.



Pinco Strain or Dead End Clamps are made in styles to accommodate conductors of any material in cable sizes up to .5 inch.



Pinco Suspension Clamps, No. 4000 Series. Available in malleable iron or forged steel, socket or clevis connector, in J-Bolt or U-Bolt construction. Also furnished with liners.

Pinco Distribution Insulators and Hardware are designed for the "right on the job" performance that keeps your vital distribution lines in active service. To you "right on the job" will mean prompt deliveries from near-at-hand warehouses of standardized interchangeable units. But it will mean, too, insulators and hardware that are far above standard in performance.

It will mean the accurate threading of pin types that reduces installation strains . . . the use of high-test porcelains . . . of accurately machined hardware. It will mean equipment that is "right on the job" *when* you want it and *how* you want it.

Pinco Insulators are cataloged in the Electrical Buyers' Reference

PINCO INSULATORS

THE PORCELAIN INSULATOR CORPORATION
649 MAIN STREET • LIMA, NEW YORK

SALES AGENTS—The Joslyn Company—New York, Rochester, Philadelphia, Baltimore, Washington, Richmond and Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Joslyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Joslyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Joslyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville; Paul Doudan—Denver; Paul Carson—Amarillo, Texas; Joslyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Joslyn Southwest Co.—Dallas, Houston.

tady. Mr. Harraden was first employ by General Electric as a student eng neer at Lynn in 1898 and was sent the Pacific Coast in 1906, where h joined the San Francisco staff. Aft the coast venture he returned to Ly and engineering work for eight year In 1915 he was sent to the San Fra cisco Exposition with other lightin men. The following year he was tran ferred to Schenectady to the lightin division. It was there that his exper ence was first turned to commercial pro motional work in the lighting field, th position he held until his retirement la month.

▶ HARRY E. WARREN, manager of re frigerator sales division of Edison Ge eral Electric Appliance Co., Inc., ha been appointed manager of the adver tising division of Hotpoint. Mr. Warre takes over his new position after si years with the Hotpoint organization during which time he served first a sales manager of the home laundry divi sion and more recently as manager o the refrigerator sales division. Before going to Chicago with Hotpoint Mr. Warren spent some years as advertising manager of Caswell, Inc., G.E. distributors in Detroit, and handled appliance promotion for the Detroit *Times*. J. W. BUGGLE, formerly assistant advertising manager, has been made manager of Hotpoint's advertising production sec tion.

▶ CLEORA EWALT, formerly home ser ice adviser for Kansas and Missou utility companies, has joined the sta of the Westinghouse Home Economic Institute at Mansfield, Ohio. The main responsibility of Miss Ewalt during the remainder of the war will be to conduct "Health for Victory" nutrition meetings at war plants in the Westinghouse central district, including Ohio, Michigan, Kentucky, Pennsylvania and West Virginia. Before joining Westinghouse she served as home lighting adviser for the Kansas Electric Power Co. and Kansas Power Co. and as home service adviser for the Missouri Gas & Electric Service Co.

▶ CHARLES B. KONSELMAN has been appointed advertising manager of the Wickwire Spencer Steel Co. to succeed GEORGE L. RANDALL, who has recently entered military service. Mr. Konselman will be located at the company's home office in New York.

▶ BURTON S. FRANCIS has been ap pointed superintendent of the induction voltage regulator manufacturing divi sion at the Pittsfield, Mass., works of General Electric Co., succeeding W. E. KRONE, who has been transferred to the staff of general superintendent of the plant. Mr. Francis entered the com pany's employ 32 years ago as an ap

ery branch of the Armed Services uses the telephone. No. 9 of a series, Airplane Spotter.

omewhere in this global war, your boy may be watching the heavens tonight. e is reminded of the Star of Bethlehem and is resolved that he and his comrades ill bring us a world ruled by the precepts of the Prince of Peace. We at home ust continue to furnish them with all they need to make this dream come true.

He's counting on YOU!

To bring peace sooner — at lower cost in precious lives — he needs overwhelming superiority in weapons. Keep those weapons flowing to him by buying War Bonds *regularly* — till the day of final Victory!

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

J-B-T VIBRATING REED FREQUENCY METERS

Sensitive . . . Yes!

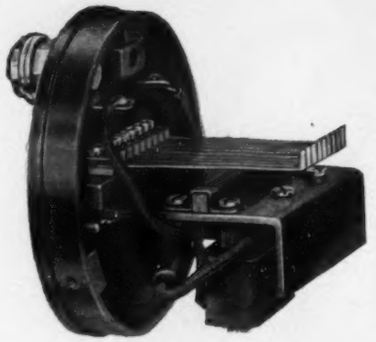
. . . sensitive enough for laboratory uses, because they are accurate to ±0.3% for full-cycle, and ±0.2% for half-cycle increment which is about as close as you can read a meter, anyway . . . sensitive enough for telephone, television and radio service and in many types of electronic equipment, because of low power consumption. For instance, Model 33-F uses only ½ watt at 60 cycles, 115 volts. Furthermore, these instruments are not affected by wave form, normal temperature change, or external magnetic fields.

Model 33-F

Size—3¼" flange, dull black metal case for flush panel mounting. 9 or 11 reeds, full or half cycle increment. Reed in resonance vibrates as shown. Simply READ THE REED, and that's your frequency.

Delicate . . . No!

. . . unless by "delicate" you mean "nicely constructed and adjusted" . . . but you certainly couldn't call them dainty or fragile . . . not if you could see the punishment they are taking every day on portable motor-generator sets, testers, and power supplies in the field. All parts of the instrument are securely anchored to the base, with lock washers at every critical point . . . the only movement is at the free end of the spring steel reeds . . . there is nothing to wear out or get out of adjustment. Non-fluid oil seal between case and base protects them against dirt and weather. They're rugged.



Interior construction of J-B-T Vibrating Reed Frequency Meters is extremely simple. In this model, the laminated core transmits the impulses to the reed bank. Note that there are no parts to wear out or get out of calibration.

J-B-T Vibrating Reed Frequency Meters are available for frequencies from 15 cycles to 400 cycles—with various reed groupings, case sizes—with full or half-cycle increment, sharp or broad response. For full details on the complete line, send for your copy of Bulletin VF-43.

J-B-T

Manufactured under Triplett Patents and/or Patents Pending.

12-JBT-4

J-B-T INSTRUMENTS, INC.

439 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

prentice toolmaker. Edwin J. Meyer has been named head of the East Plant Ordnance division and will continue to serve as superintendent of East Plant motor manufacturing.

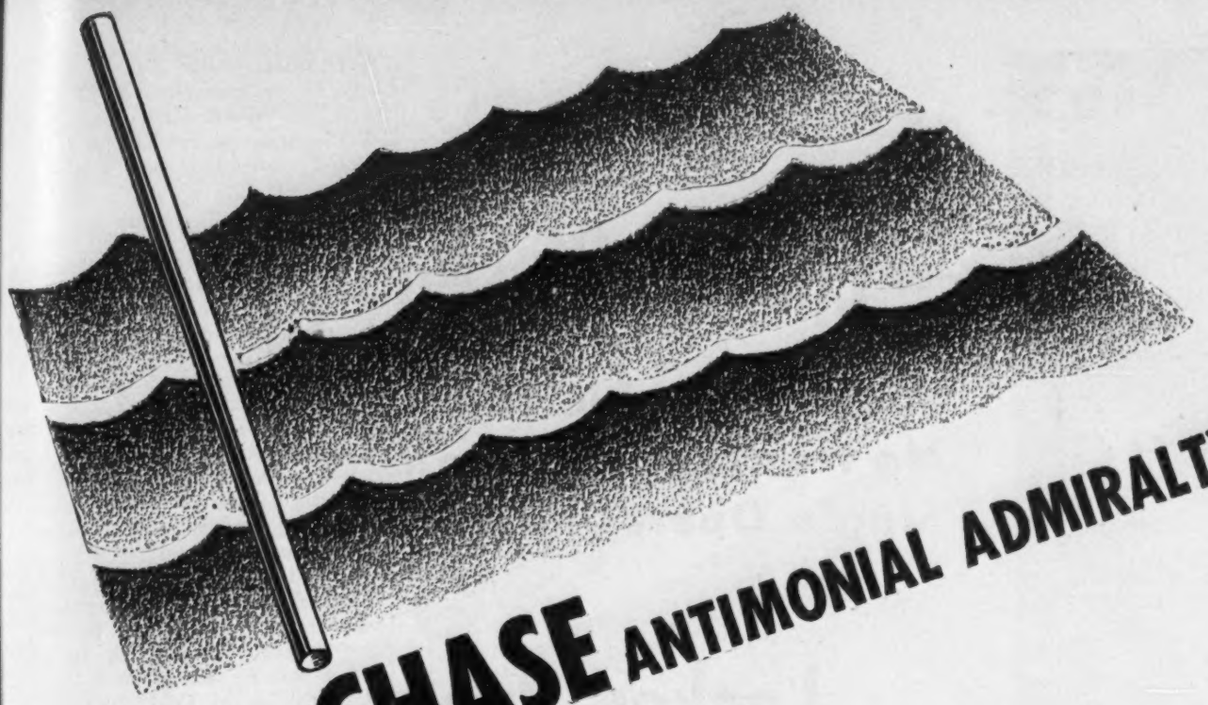
▶ JAMES R. WEAVER has been appointed manager of the Naval Ordnance Plant at Center Line, near Detroit, Mich. The Center Line plant was transferred in October from its previous management to Westinghouse, which is also operating ordnance plants for the Navy at Canton, Ohio, and Louisville, Ky. Mr. Weaver has been transferred to the Center Line plant from the Louisville plant, where he had been manager since November, 1940. His successor as manager of the Louisville operation is C. E. SHIPLET, formerly superintendent.

▶ L. F. MCGLINCY has been appointed assistant manager of operations, Pittsburgh district, American Steel & Wire Co., subsidiary of U. S. Steel Corp. LOREN J. WESTHAVER has been named general superintendent of the Donora (Pa.) Steel & Wire Works, succeeding Mr. McGlincy. E. A. MURRAY has been appointed assistant manager of the manufacturers' sales department in the Chicago sales office of the American Steel & Wire Co. Mr. McGlincy became identified with American Steel & Wire in 1924 and had been general superintendent of the Donora Steel & Wire Works since 1941. Mr. Westhaver has been identified with the company since 1928 and Mr. Murray since 1934.

▶ J. F. PEDDER has been appointed advertising and sales promotion manager of Frigidaire's appliance division, Dayton, Ohio. Mr. Pedder was formerly assistant advertising manager of this division. T. W. MARKHAM, now on another assignment, will resume his former position as advertising and sales promotion manager of the Frigidaire commercial and air conditioning division.

▶ VICTOR S. PETTERSON has been appointed superintendent of the rubber-handling department of the Simplex Wire & Cable Co., Cambridge, Mass., where he will have charge of the regular mill, regular insulating, vulcanizing, continuous vulcanizing and plastex activities of the plant. He joined Simplex 15 years ago. W. C. HAMEL succeeds Mr. Petterson as foreman of the regular mill.

▶ O. J. SCHROEDER has been appointed vice-president in charge of manufacturing, equipment and engineering of the Save Electric Corp. Mr. Schroeder is participating in the corporation's expansion of Verd-A-Ray, its new lighting development. First joining the lamp division of Westinghouse Electric & Manufacturing Co. in Milwaukee, Wis., in 1917, he was appointed assistant su-



CHASE ANTIMONIAL ADMIRALTY*

For brackish cooling waters

Picking a condenser tube alloy for salt or brackish cooling water conditions? Then consider this outstanding performance record. Millions of pounds of Chase Antimonial Admiralty tubes in service. Many of them installed in 1935—and still going strong. Not one service failure has been reported from dezincification.

Doesn't this give you most of the facts you need? You can get the rest of the story quickly and easily—just phone the nearest Chase Sales Service Office for full information on Antimonial Admiralty.

* U. S. Patent No. 2,061,931.

POINTS TO REMEMBER ABOUT ANTIMONIAL ADMIRALTY

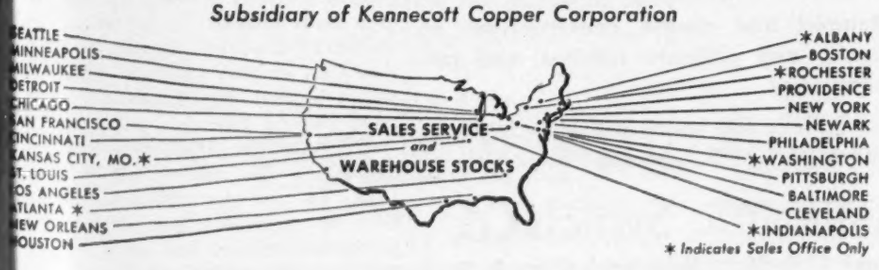
1. *Extraordinarily resistant to dezincification.*†
2. *Free from intercrystalline corrosion.*
3. *Costs no more than plain Admiralty.*

† It's the antimony that does the trick. A highly effective dezincification inhibitor, antimony greatly increases the resistance of Admiralty to this form of attack by saline cooling waters. Long service records show no evidence of dezincification in Antimonial Admiralty.

CHASE

CHASE BRASS & COPPER CO. *Incorporated* **WATERBURY, CONN.**

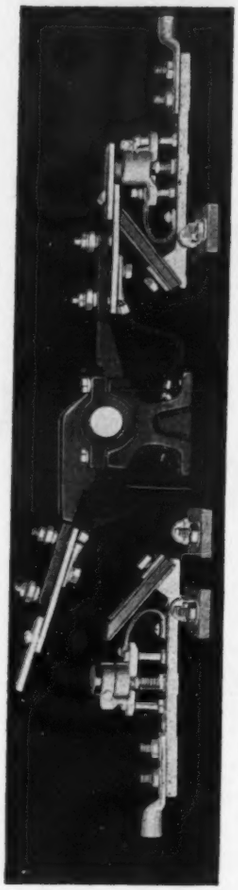
Subsidiary of Kennecott Copper Corporation



* Indicates Sales Office Only

SPECIAL STOCKS OF ANTIMONIAL ADMIRALTY *at*

Houston
Los Angeles
New Orleans



← Locked Closed

Actually Double Throw
No Neutral Position
Single Operating Coil

← Locked Open

Automatic Transfer Switches

ASCO Electrically Operated SWITCHES

THE function of an automatic transfer switch is to connect a load to either of two sources, a normal source or an emergency source. The exacting requirements of this duty govern every detail of Asco design.

1—No neutral position is possible due to coil or control failure.

2—Actual double throw construction provides inherent mechanical and electrical interlocking.

3—A simple powerful mechanism locks switch positively on selected source.

4—Operating current is obtained from the source to which the load is to be connected.

5—Rugged and simple construction; no hooks and delicate latches and mechanisms.

If interested in Solenoid Valves, ask for Bulletin 160.

Write for Bulletin 560 which will give details of construction of ASCO Automatic Switches.

Automatic Switch Co.

41-C East 11th St. New York City, 3, N. Y.

perintendent of that plant in 1929. In 1932 he was transferred to Bloomfield, N. J. During his years of service with Westinghouse he has had to his credit several inventions on lamp-making equipment.

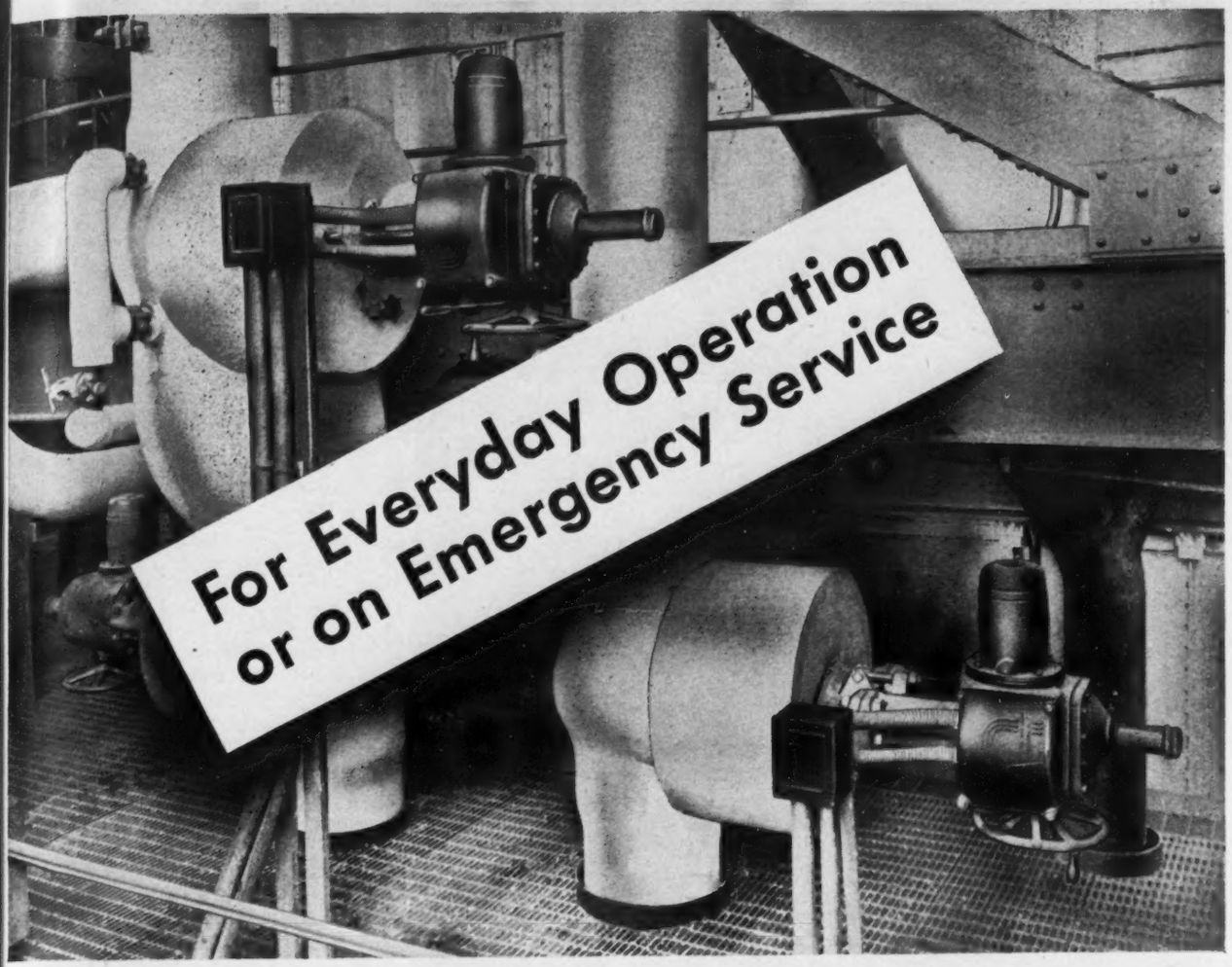
▶ VINCENT C. STANLEY, until last summer president and general manager of the Gamewell Company, Newton, Mass., has been appointed administration officer of the termination board of the Boston Ordnance District.

▶ J. C. COFFEY has been appointed assistant to the sales manager of the Eureka Vacuum Cleaner Co., Detroit, Mich. Before joining Eureka Mr. Coffey was with the Jam Handy organization as senior account executive, working on visual education programs, sales meetings and public relations programs. Previously he was sales promotion and sales training manager of the Frigidaire's branch operation in St. Louis. Before that he was in the sales planning division of Frigidaire division's home office.

▶ W. H. MAXWELL has been made general sales manager of the Wolverine tube division of Calumet & Hecla Consolidated Copper Co. For the present Mr. Maxwell will divide his time between New York and Detroit, making Detroit his permanent headquarters after January 1. Since 1932 Mr. Maxwell has had charge of Wolverine's Eastern sales office in New York. He has been with the company for thirteen years. R. F. MOODY has been named assistant general sales manager.

▶ R. B. SAYRE has taken up his duties as manager of the Memphis office of the Graybar Electric Co., Inc. He replaces O. B. Chandler, who died recently after 24 years of continuous service with the company. Mr. Sayre, whose service record with Graybar totals 22 years, has been closely identified with the electrical industry for many years, particularly in the Memphis district. Since 1939 he has been at Graybar Atlanta as manager, outside construction department.

▶ ALEXANDER KENNEDY, JR., has been appointed assistant to the manager in charge of engineering of the federal and marine divisions of the General Electric Co. and HOWARD P. BISH has been made assistant to the manager in charge of administrative affairs. Both are newly created positions. A graduate of Cornell, Mr. Kennedy first entered General Electric's employ in the "test" course in 1908, and has been identified with marine affairs since 1919. For the past ten years he has been the application engineer on main propulsion turbines and gears designed and manufactured for the new Navy



LIMITORQUE VALVE CONTROLS

Always respond . . .

ARMY E NAVY

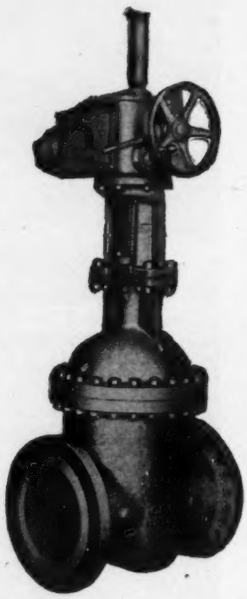
Proved Dependable—that is the reputation LimitTorque Controls have earned by the installations in many well known power plants and central stations.

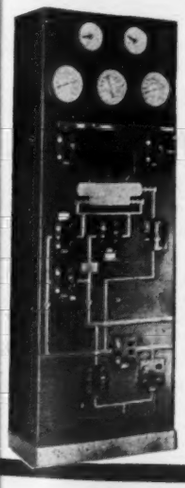
Regardless of conditions, whenever a button is pushed at either a centrally located master control panel or a convenient individual push button station . . . the LimiTorque functions and the valve opens or closes as desired . . . quickly, safely. No effort is required, no time is wasted.

This makes remote operation of valves most practical, permits key workmen to be responsible for operating valves in all parts of the plant from one central point with a full knowledge of the status of valves at all times.

LimiTorque can be applied to all types of valves from 3" to 96" diameter . . . on either new or existing equipment.

Investigate LimiTorque today . . . write us.





A typical Limitorque Control Panel

PHILADELPHIA GEAR WORKS, INC.

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

Erie Ave. and G St., Philadelphia 34, Pa. • New York • Pittsburgh • Chicago

THE LAMPS ARE BRIGHT AGAIN
Throughout the night, the lamps are bright again. Symbolic of victory . . . these lamps stay bright, and so they shall remain.
Throughout great cities and small towns, SLATER Street Lighting Lamps again scintillate the brightness which reflects the light of faith in the future . . . and an enduring freedom from darkness.
New York City's Westside Express Highway lighted with SLATER LAMPS.
SLATER ELECTRIC & MFG. CO.
MANUFACTURERS OF STREET LIGHTING LAMPS AND ELECTRONIC TUBES
BROOKLYN, NEW YORK
SLATER

combat vessels. He has also taken a leading role in the application of propulsion and auxiliary equipment for the Merchant Marine. Mr. Kennedy is a member of the Society of Naval Architects and Marine Engineers. Mr. Bish enrolled in the company's "test" course in 1919. The following year he was transferred to the marine engineering department, in 1940 entered the federal and marine department and in 1942 was made manager of sales of the Navy ship section, the position he held until his present promotion. Mr. Bish is a member of the Society of Naval Architects and Marine Engineers and of the Society of Naval Engineers.

OBITUARY

Fred P. Auxer

Fred P. Auxer, founder and president of the National Telephone Supply Co. of Cleveland, Ohio, died on November 25, in his sixty-eighth year. Mr. Auxer founded the company 42 years ago and since that time had been active in the communication and electric light and power fields. Mr. Auxer was born in Cleveland and received his education and early business training in that city, which he always made his home. He was one of its most prominent citizens, having contributed generously to practically every charitable or civic enterprise that was of real worth.

Before organizing the National Telephone Supply Co. Mr. Auxer was employed by McIntosh-Hunting Co. He started his own company in 1901 and had continuously operated from that time on in the production of products for communication and power companies. He was a member of the National Manufacturers Association.

•

▶ GEORGE A. BARTLETT, 68, chief engineer of the Worcester, Mass., municipal auditorium, died at a hospital in that city on November 27, the first day of his retirement after ten years in that position. He was educated at Worcester Polytechnic Institute.

▶ FRANKLIN DE RONDE FURMAN, author of technical and historical books, who had been on the faculty of Stevens Institute of Technology for 48 years and served for thirteen years as dean of the college, died on Nov. 21 at his home in Passaic, N. J., in his seventy-fourth year. He was a member of the American Society of Mechanical Engineers, the mechanical branch of the Newcomen Society of England and the Society for the Promotion of Engineering Education, and was a fellow of the American Association for the Advancement of Science.

The Attack Your Extra Bonds Must Back

Every penny counts — At FEDERAL, where communications equipment is made for our armed forces, an idea is spreading. For every axis plane reported shot down, employees drop an extra coin in a box — for extra bonds for extra bombs and bombers.

Thundering out of the overcast
Like a midnight express
The first wave of bombers
Spots the twinkling steel mill . . .
Blasts it into a roaring volcano
As the hinges of hell open
And fill the sky with daggers of light
And streaking, shrieking meteors of ack ack

Silhouetted against this inferno
Another target looms
And the young voice of the squadron leader
Speaking over the interplane radiotelephone
Calmly directs the *next* wave of bombers
To the doomed power plant ahead . . .

• • •

Shuddering under the impact
Of flak and fighter fire
The rocketing war birds
Level off into their "run"
And the pale bombardier catches his breath
Like he used to when he called signals
In the games back at "State"
As he whispers . . . *'Bombs . . . away!'*

Did he say *"bombs" . . . or "bonds"?*

• • •

Down they hurtle
The bonds
That have been converted into TNT . . .
Your milkman's bond
Your stenographer's bond
The bond of the woman who cleans your office
Of the neighbor whose boy was in today's battle
And YOUR bond . . .
Your EXTRA bond . . .
Is THAT there, too?

• • •

Here at I. T. & T.
And its associate companies
Communications equipment and services
Are only part of the job . . .
Every man and woman here
Is buying war bonds
Extra war bonds
To back the attack
And bring our sons and brothers
Home

I T&T **International Telephone and Telegraph Corporation** *67 Broad St., New York 4, N. Y*

Manufacturing Associate:
Federal Telephone and Radio Corporation

MANUFACTURING-MARKETS

Dealer Program Stimulates Bonds

The "U" Plan for "Victory Day," a plan offered by Universal Household Helps, emphasizes the promotion of war bonds by dealers to help the war effort and is steadily gaining recognition throughout the country.

The sale of bonds by dealers is stressed by Universal because it believes that dealers have a definite sales set-up which can easily be employed to stimulate war bond sales in their communities. Many dealers will find the sale of war bonds and stamps will increase traffic in their stores, thus bringing them into more direct contact with customers.

The plan, published in a convenient 20-page booklet, also proposes that all dealers tie in whatever advertising they are doing with war bonds. A series of dynamic "U" Plan for "V" Day ad-mats have been especially designed by Landers, Frary & Clark for dealers to use in their local newspapers.

With the continued promotion of war bond sales by electrical dealers tied in with the "U" Plan post-war program, Universal believes that dealers will benefit, while at the same time making a full contribution to the war effort.

•

Big Gains Foreseen in Television

Within five years after commercial resumption of television, sight and sound programs, broadcast by network and individual stations in 157 key cities, will be available to 60 percent of the people of the United States if the radio industry can produce a television home receiver priced at approximately $200. This was forecast by Thomas F. Joyce, manager of the radio, phonograph and television department of the Radio Corp. of America, speaking before a joint meeting of the American Television Society and the Advertising Club of New York. "Such a receiver, I believe, is possible," he said, "based on 1940 labor and material costs, and assuming no excise taxes. Of course, the post-war price would be increased by the factors of inflation and excise taxes."

In a clear-cut analysis of post-war television markets marked by a strict adherence to practicalities and known facts, Mr. Joyce declared that the number one problem of the post-war television industry was an acceptable low cost radio television receiver.

Within ten years after full commercialization of visual broadcasting, Mr. Joyce declared, television will be a billion-dollar industry.

Others who spoke included Robert L. Gibson, assistant to the manager of broadcasting of the General Electric Co., and Allen B. DuMont, president of the Allen B. DuMont Laboratories, Passaic, N. J.

ALL-FLUORESCENT LIGHTING JOB—Here is Lieut. Venetia Valsakos, Army Nurse Corps., making beds on the first hospital train to be completely illuminated exclusively with fluorescents. The all-fluorescent lighting job, done by Sylvania Electric Products, Inc., equipped the ten-car train with 59 40-watt single-lamp troughers, 12 fifteen-watt single lamp troughers, 18 six-watt single-lamp wall fixtures and eight 15-watt desk lamps

Blood Discusses Future Distribution

Post-war adjustment and prosperity will receive a disorganizing jolt if the government permits its own distribution agencies, conducted for the benefit of the Armed Forces, to sell directly to private consumers, Howard E. Blood of Detroit, president of Norge Division of Borg-Warner Corp., told the Chicago Federated Advertising Club in a recent address on the future of distribution.

Pointing out that "demobilization will be followed by the need for the government to dispose of large quantities of surplus goods," Mr. Blood said:

"Such disposition may, if not properly regulated, swamp civilian markets and disorganize for a long period the normal function of both the production and distribution of certain goods."

Mr. Blood, who is chairman of a subcommittee on post-war distribution for the National Association of Manufacturers, warned against the dangers of enacting restrictive local and state laws which disrupt distribution, run up costs, paralyze business and destroy free enterprise. He declared that post-war employment conditions and living standards will depend almost entirely on how effectively the nation can distribute the goods it produces.

Mr. Blood said that Americans owe to advertising a large share of their standard of living, which he termed the world's best. "New inventions and products, which will come in large volume after the war, would be of little value were it not for the advertising, which, not only tells people of their availability, but stimulates desires not formerly in the people's consciousness," he said. "Advertising is necessary to the maintenance of our free distribution system, which is a vital part of our private enterprise system. . . ."

•

Phelps-Dodge Aluminum Plant Halted

War Production Board has reported that a third new aluminum plant, that of the Phelps-Dodge Copper Products Corp. at Hammond, Ind., had been halted while still under construction. Part of a general cut-back in aluminum facilities, the revocation of priority ratings, followed by about two weeks shutdowns of a $16,000,000 aluminum plant at Memphis, Tenn., and a similar plant at Columbus, Neb. Both were in a more advanced stage of completion than the Hammond plant.

When the two previous shutdowns were reported the WPB said the action resulted from downward revision of the

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Wesco know-how revamped ordnance plant layout

New Electric System Ended Installation Delay; Sped Urgently Needed Capacity

In Wisconsin, contractors rushed to complete an important ordnance building. Plans for the electrical system specified a Vapor-proof 600-volt fusible distribution panel. The local Wesco house, called in on the job, advised that no such panel is made in fusible type nor was there a suitable substitute in 600-volt ratings.

Instead, Wesco suggested using individual AB Vapor-tight Breakers, ganged up, and a Vapor-tight junction box for main feeder. The revised system as laid out was at once approved, equipment was promptly delivered and the installation completed without delay. Initial production in the ordnance works was advanced by many hours.

Wesco's job is not only to know thoroughly every detail of electrical wholesaling, but to help customers solve their many and difficult electrical problems. Today, this know-how is devoted to winning the war. After Victory, Wesco's 80 Branches will stand ready to help industry and business convert to the big peacetime job that lies ahead.

WESCO SPEEDS WAR PRODUCTION

* Production of mosquito boats was threatened by a paralyzing 45 to 60 day delay in obtaining vital cable. Wesco located and delivered the necessary cable—in 24 hours!
* Wesco rushed 68 separate electrical items to an airfield in 3 days—81 days faster than the best promised delivery by manufacturers.

• • •

WESCO SERVES BUSINESS

* By providing trained sales and engineering personnel.
* By warehousing stocks in anticipation of customers' needs.
* By assembling all parts of an order in one shipment.

DONATE YOUR BLOOD AND SAVE A FIGHTER

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

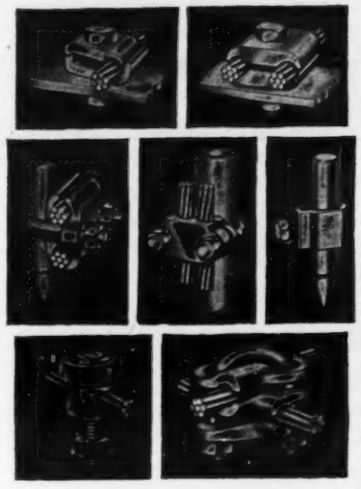
"You can get **ANY** Grounding Connector—

—in the **COMPLETE** line."

The pictures below can only give you an idea of the variety, because **Penn-Union makes ALL good types.**

Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union connectors are the choice of leading utilities, industrials, contractors and electrical manufacturers.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Army's estimates of aluminum needs, together with an unexpectedly high rate of productivity from plants already in operation.

•

Lincoln Sees Freedom Gone

The "vaunted freedom of the American people is gone" and the nation is under the control of a government by edict, James F. Lincoln, president of the Lincoln Electric Co., Cleveland, asserted recently in Chicago. If this control is temporary the nation's liberties will return, he stated, but if not the voter must go to the polls and elect the kind of people who will support a democratic type of government.

Mr. Lincoln, who recently defied the Navy department's order directing his company to refund $3,250,000 in alleged excess profits to the government, spoke at a meeting of the Purchasing Agents' Association of Chicago at the Hotel Sherman.

Lincoln said he was opposed to renegotiation of profits on war contracts because it put into the hands of a few men the power to decide what payment will be made without the manufacturer having recourse to the courts. He urged that renegotiation be placed on the same basis as taxes, on which a right of appeal is given.

He expected a hearing of his company's request for an injunction to be set in federal court within the next few weeks. If the injunction is refused the company will take the case to the Supreme Court, he asserted.

•

Worthington Makes Refund

Under an agreement reached by the management of Worthington Pump & Machinery Corp. and governmental renegotiation authorities, the company will make a net refund on 1942 war contracts of $551,426. Under the settlement the government recovered a gross amount of $2,100,000 from which was deducted $1,548,574 previously listed as income tax liability.

The effect on earnings of the renegotiation agreement is to reduce net profit from the $2,758,890 figure previously reported, equal to $7.86 a share, to revised profit of $2,207,463 or $5.79 a share.

•

Curtis Gets "M" Award

Curtis Lighting, Inc., Chicago, has been given the U. S. Maritime Commission award of merit.

***for* NIGHT REPAIRS *and* LINE PATROL**

Linemen's Flare Lights

An efficient, economical form of portable illumination—giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes—20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick, dependable illumination is imperative. Easily lighted in any weather by self-contained friction cap. No. matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING
No. 3020—20 min., per case of 72...$12.00
No. 3030—30 min., per case of 36... 9.00

Central Railway Signal Company, Inc.
272 Center Street
NEWTON, MASS.
Plant Locations: Hammond, Ind.; Needham Hts., Mass.

Birth of a *kilowatt*

FORE CURRENT can surge through copper segments someone has to worry about faultless insulation between those segments. Mica, Insulation Headquarters, takes care of that for you — beginning with pure, raw mica from our own mines — richest deposits in the world.

SKILLED NATIVES trim and split this raw mica into thin splittings (one thousandth of an inch) ready for shipment to our plant where they are built up in a wide variety of Micanite electrical insulations.

CONTINUOUS automatic layer machines combine the splittings with cement — the first step in forming sheets from which Micanite commutator segments and other flat shapes are made.

THERE'S NO DELAY in securing segments and other built-up mica parts today. Modern equipment at Mica Insulator is ready to go to work for you — following your exact specifications, fabricating and molding to minute tolerances — quickly.

GENERATOR RECONDITIONING time may be a stumbling block for peak, wartime power generation, especially when odd-shaped, unusual-sized segments and rings are needed for unusual commutators! But Insulation Headquarters is fortified against such delays with complete equipment — to cut and mold the Micanite parts you'll need to keep those generators humming. For another time-saver, order all of the electrical insulations you'll need for transformer, motor and cable repair work — at the same time.

Mica Insulator Company

200 Varick Street, New York 14, N. Y. • 600 Van Buren Street, Chicago 3, Ill. • 501 Marion Building, Cleveland 13, Ohio

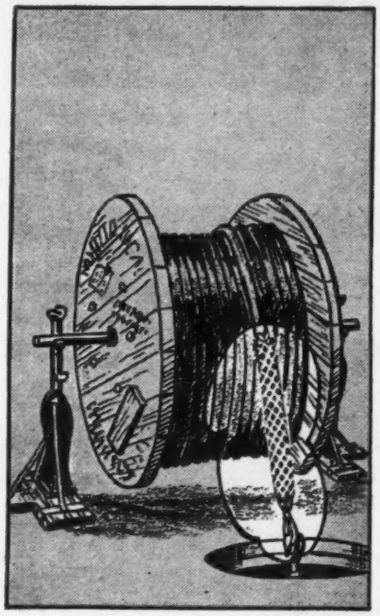
Representatives in principal industrial centers

SPEED

CONSTRUCTION

and EXPANSION

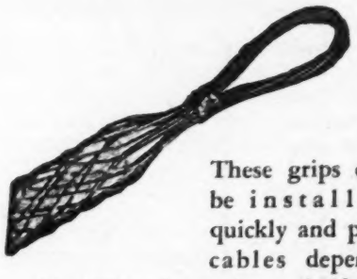
of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in

Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY

OVER 35 YEARS SERVICE TO THE UTILITIES

3146 CARROLL AVENUE • CHICAGO, ILLINOIS

Field Reports on Business

A significant change in the economic situation is the increase in the number of cutbacks in the war production program. Electrical manufacturers report, however, that orders for certain types of electrical equipment for war plants are holding up well in view of the lag in heavy construction.

NEW YORK

In the New York area the Christmas rush of business is exceeding all expectations. Holiday shopping has expanded in volume to the extent that some stocks of merchandise will be depleted before the Christmas period ends, while others will emerge with great, tearing holes along the shelves. The Federal Reserve Board reported last week that department store sales were 13 percent higher than during the corresponding week a year ago.

In the wholesale market sales continued to rise despite the fact that stocks in apparel items were limited and some merchandise unable to be assured future delivery. Although some of the elaborate Christmas entertainment the stores have been throwing in for good measure is omitted this season, Santa Claus returned to the scene, as usual. Jack LeClair, the famous clown, whose illuminated nose enhances his popularity, is holding forth again in McCreerys and Gimbels has a merry-go-round.

Civil engineering construction volume in continental U. S., according to the *Engineering News-Record,* totaled $52,181,000, 49 percent below the total for the corresponding week in 1942, but tops the $36,523,000 reported for the preceding week. Current week's volume brings the 1943 construction total to $2,937,565,000, which, on a weekly average basis, is 67 percent below the $9,035,350,000 for the 49-week 1942 period.

CHICAGO

Outside of a few indexes, Chicago business continues the steady upward trend that has marked its career all through the year, according to the monthly analysis of the Chicago Association of Commerce. Factory payrolls during October advanced 30.2 percent, compared with the same month in 1942; electric power production was up 11.3 percent, and department store sales were 5.3 percent better than last year.

In the construction field the number of building permits actually issued was 21.0 percent ahead of last year, although the money invested was below the figure set in 1942, when large war plants were still in the making. Real estate sales were 19 percent more numerous than those recorded twelve months previous, with capital invested up in proportion.

Electrical manufacturers continue to report that orders for certain types of industrial electrical equipment for war plants are holding up "surprisingly well" in view of the general lag in heavy construction. Occasional special orders for heavy utility equipment are reported by the larger companies. A 25,000-kva., 69-kv. power transformer was shipped recently by the Allis-Chalmers Co. to an Indiana company for interconnected tie-line operation.

Edison General Electric Appliance Co. was awarded a Navy order during the week ended November 24 for 60 immersion heaters. Lenz Electric Manufacturing Co. also received a Navy order totaling $3,122 for "cable." During the same week the B.-W. Construction Co. and the Sherry Richards Co. were awarded a joint contract totaling in excess of $7,500,000 for a 1,500-unit war housing project from the Federal Public Housing Authority.

NEW ENGLAND

An announcement by the Senate naval affairs committee that a 3-billion-dollar program for shipbuilding has been approved welcomed here where industrial activity is tied so closely to shipbuilding.

Middleboro, Mass., municipal electric department plans to make changes and repairs in its Middleboro-Plymouth 22-kv. line at a cost of $10,000. Poles and line hardware will be required. Completion of work in Boston, which includes installation of lighting and alarm systems in the Shawmut National Bank's drive-in stations will be carried out at once, and the opening of the new Federal Savings & Loan Bank, which has installed 20 indirect lighting units in its main lobby, are the beginning of moves toward normal active lighting sales as a result of an availability of fixtures and other lighting supplies.

Waterbury Clock Co. has been allocated $115,000 by the DFC for plant expansion and additional equipment. Bridgeport Metal Goods Co. has been awarded a Navy contract for a large number of lamp reflectors, and M. B. Foster Electric Co., Boston, has been ordered to convert an electric system from d.c. to a.c. at a Naval station at a cost of $14,644.

Bids placed by manufacturers for navy equipment cover a wide range of electrical applications but tend to smaller sizes and lots. Small knife switches, fuses, insulating materials were among the items of interest to Connecticut manufacturers last week. Electro-medical apparatus, phenolic laminated sheets for insulating purposes, small motor-driven fans, and blowers were bid by Massachusetts firms.

PACIFIC COAST

California factory employment, exclusive of office workers, dropped from 911,300 in September to 900,200 in October. However, the decrease is largely seasonal, such as canning help, and the total is expected to rise next year as the Pacific War is stepped up. Government construction reflects the rising Pacific Coast intensity.

DFC plans a $2,000,000 dam on Verde River near Phoenix to serve Phelps Dodge copper mines as well as adjacent water users. WPB is working on designs for an alumina clay reduction plant to cost $4,000,000. Salem, Ore., will be the site instead of Castle Rock, Wash., as first planned.

Orders and prospective orders include considerable shipment of wire and transformers for Army installation near Yuma, a group of 200 and 250 kv. transformers for Los Angeles; $15,000 of large fluorescent fixtures for Army School at Stanford; coaxial cable for Treasury Department at San Francisco; a $304,000 low bid for machine and electrical services for naval installation at South San Francisco.

Airfield lighting orders continue with several scattered fields in area between Sierras and Rockies; but completion of most plants and fields is signified by information circulated by several major manufacturers that they can now again sell floodlights from stock.

Surety LINEMAN SAFETY EQUIPMENT

When WORKING COMFORT counts!

• Take the Surety Turn-Cuff lineman glove for example—born out of the need for gloves to give linemen maximum safety and comfort in all weather conditions. Actually controls surface creepage in rainy weather because the cuffs turned up form a petticoat insulator effect — turned down, a two inch longer protective gauntlet. Your own field tests will prove their superiority.

•

WHAT DO LINEMEN THINK ABOUT TURN-CUFFS?

The constantly increasing use of Turn-Cuffs is an excellent measure of the lineman's opinion—many of them enthusiastically express their praise for the added safety and extra comfort. Send today for complete information.

THE Surety RUBBER COMPANY
CARROLLTON, O

New Applications of Plastics Told

Three engineers of the Formica Insulation Co., Cincinnati, took members of the Cincinnati Foreman's Club on a "post-war tour" of the possibilities imminent in applications of laminated plastics. Wartime refinements and new developments in techniques the engineers disclosed will open new uses for the laminated plastic products applied in numerous vital ways during the war.

Conducting the seminar illustrated with motion pictures in color describing fundamental changes in manufacturing technique which combined with improved resins will provide laminates with markedly superior quality compared to products previously made, the engineers predicted "many present indications for pleasant surprises in the post-war world of tomorrow."

J. J. Cochrane, chemical engineer; George F. Schatz, architectural engineer, and J. C. Pitzer, research engineer in charge of the production engineering office, comprised the Formica trio presenting the program.

Mr. Cochrane, discussing the decorative applications of laminated products, said "over a period of twelve years, in co-operation with suppliers of synthetic resins, Formica research has led to a series of improvements now generally accepted as approved construction materials by architects and designers."

He related that "while the Formica plant is engaged in all-out war production in all branches of output, wartime developments in this field are preparing us for an even broader application of Formica in the post-war picture."

Mr. Schatz expressed the opinion that "immediately following the war there will be great demand for plastic materials in the industrial, architectual and commercial design fields."

A talk on the origin and development of the plastics industry was given by Mr. Pitzer.

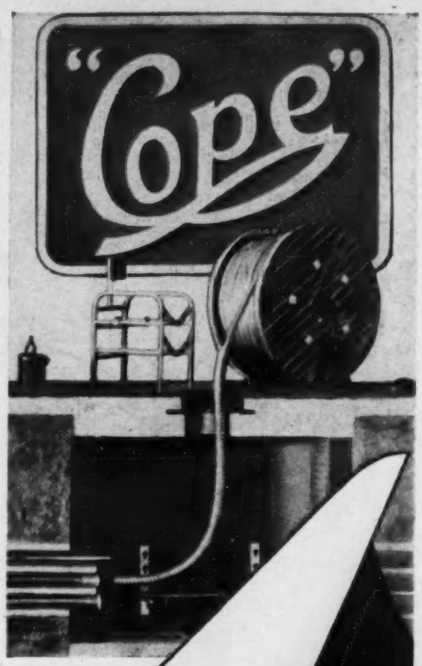
•

G. E. Motor Engineers Save 63,000 Lb. of Copper

Forty thousand pounds of noncritical material have replaced, with resulting advantages, more than 63,000 pounds of critical copper and brass in certain small parts used in electric motors manufactured at the Fort Wayne Works of the General Electric Co.

The Fort Wayne engineers have also redesigned numerous parts, such as gears, electric tool housings and fans, for use of plastics instead of

"Cope"



UNDERGROUND EQUIPMENT

CONDUIT RODS
CONDUIT TOOLS
PULLING RIGGING
CABLE FEEDERS
CABLE RACKS
CABLE ARMS
COMPOUND KE
MANHOLE GU
MANHOLE L
MANHOLE CO
DRAWING-IN
CABLE

Only the Best for over 50 Years

WRITE FOR CATALOG

T. J. COPE, INC.
6120-6122 VINE STREET
PHILADELPHIA, PA.

NEW!

DRY AIR PUMP

for Economical Dehydration of Air

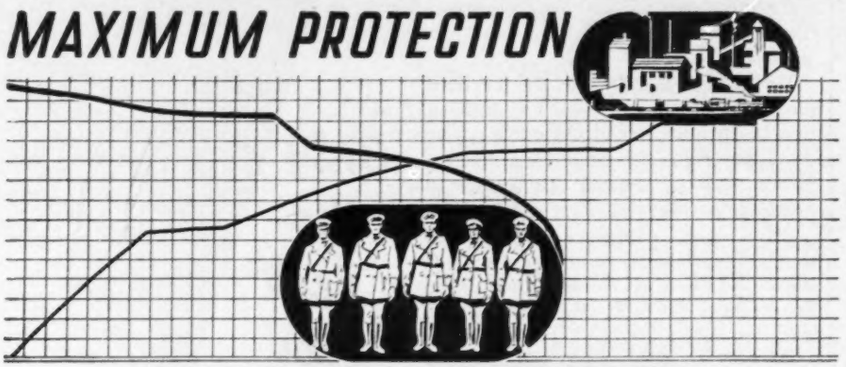
This easily operated hand pump quickly and efficiently dehydrates air *wherever dry air is required.* One simple stroke of this pump gives an output of about 23 cubic inches. It drys about 170 cubic feet of free air (intermittent operation), reducing an average humidity of 60% to an average humidity of 10%. The transparent main barrel comes fully equipped with one pound of air drying chemical. Inexpensive refills are available.

The Andrew Dry Air Pump has a multitude of applications in addition to providing moisture-free coaxial cable lines.

ANDREW CO.

363 EAST 75th ST., CHICAGO 19, ILL.

MAXIMUM PROTECTION



MINIMUM MANPOWER

● This highly desirable achievement in the protection of industrial plants and properties from the constant threat of sabotage, espionage and theft, is accomplished with the installation of modern A. A. I. Automatic Alarms. Operating on a principle of sound detection, tiny robot sentries, attached at intervals along protective fence lines, pick up delicate sound vibrations, transmit and amplify warning signals and dispatch headquarters guards to the actual zone of disturbance, thereby reducing to a negligible minimum, the need for outside sentries. Relatively low in cost, easy to install and simple to maintain, Automatic Alarm Systems are now guarding American industries, large and small, from immediate and future hazards.

Write for Literature

AUTOMATIC ALARMS

848 MARKET STREET

Licensed under DuPont and Asiatic Patents

AUTOMATIC ALARMS *Incorporated*

YOUNGSTOWN, OHIO, U. S. A.

SALES OFFICES: Philadelphia, Chicago Detroit, and Toronto, Canada.

copper, brass, aluminum or steel. Many of the parts thus changed will continue to be made from plastics, since improved quality has resulted in these cases.

•

Postwar Planning Contest for Lincoln Employees

Employees of the Lincoln Electric Co. of Cleveland have been offered a post-war planning contest having as its purpose the gathering of all ideas of employees to assist management in planning for the future. Prizes in the amount of $900 are offered and winners will be announced August 1, 1944. The subjects suggested for cover include: (1) Post-war products which the company is in a position to build and which are along the line of its present endeavor, and (2) methods of manufacturing such post-war products suggested or method of manufacturing its present products.

•

G. E. Credit Corp. Allowed to Open Branch Offices

Announcement has been made by the New York State Banking Department that it has authorized General Electric Credit Corp. to open a branch office at each of the following locations: Boston, Detroit, Chicago, St. Louis, New Orleans, Philadelphia, Cleveland, Dallas, Tex.; Los Angeles, San Francisco and Portland, Ore.

•

Electronic Production in Tubes Increased

Reflecting the important part electronics is playing in the war, the Westinghouse Lamp Division at Bloomfield, N. J., recently reported its production of electronic tubes is eleven times as great as it was just two years ago.

Ninety-eight percent of all electronic tubes being produced by the company are for war use, either in communications equipment or for industrial applications in war plants, such as the welding of planes and the reflowing of tin.

•

Energy Requirements Up

Electric energy requirements of the principal public utility systems of the country during October totaled 19,000,605,000 kw.hr., a gain of 16.6 percent over the same month last year, the Federal Power Commission has reported. Utility estimates of peak demands for December, 1943, as reported to amount to 37,705,825 kw., a decrease of 19,000

kw. from the similar forecast submitted by the utilities in their September report.

•

Suggest Manufacturers Trade Own Radio Tubes

Radio tube manufacturers would sell tubes among themselves to assure a broader and more equitable distribution of non-military tubes to distributors under a proposal laid before the Electronics Distributors Industry Advisory Committee recently.

The proposal would not necessarily add to the total supply of tubes for civilians, but would result in distribution of the existing supply in a pattern following that of 1941 closely. Manufacturers would offer each other a percentage of their own tubes. This would assure that each manufacturer would be able to ship his distributors some tubes of all models which may now be made. Shipments to distributors would then be made on the basis of tubes and types of tubes so shipped in 1941. Distributors would work out for themselves the terms on which they would pass the tubes along to dealers.

•

Utility Coal Consumption

Electric utility power plants consumed 7,621,986 tons of coal in October, the Federal Power Commission has reported. The commission announced that the coal stocks of electric utility power plants as of November 1 were 10.8 percent less than stocks of the same date last year.

Of the total consumed 7,320,910 tons were bituminous coal, an increase of 5.0 percent over September consumption, and 301,076 tons were anthracite, which was a decrease of 2.8 percent, compared with September.

•

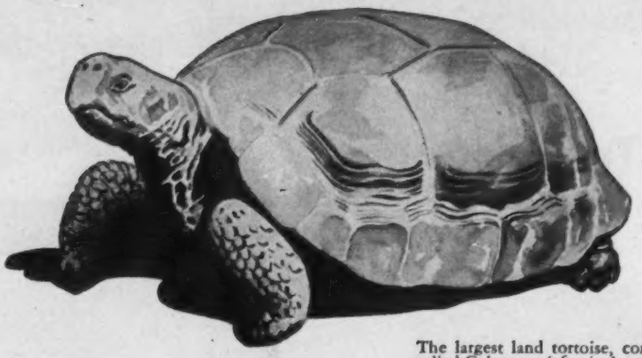
McGraw Electric Votes 50c

McGraw Electric Co. has declared an extra dividend of 50 cents a share on its common stock, payable December 29 to stock of record December 13, bringing payments for 1943 to $1.50, against $2 last year.

•

Vote Alcoa Merger

Stockholders of Aluminum Co. of America have unanimously approved a three-for-one split-up in the common stock and the absorption by merger of a partially owned subsidiary, Aluminum Manufacturers, Inc.



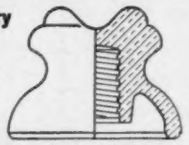
The largest land tortoise, commonly called Galapagos (after its home in the Galapagos Islands) lives, sometimes, in excess of 100 to 150 years.

Even if he lives to be 175...A Hemingray Glass Insulator Can *Outlive Him*

Three reasons for the long life of Hemingrays. First, the "secret" glass batch-mix—climax of 87 years of experience. Second, Owens-Illinois "quality" production control. This results in insulators without voids, stresses or strains—so homogenous that they are impervious to moisture-penetration and operating temperature changes. And third, the fact that time does not affect their structure. You could remelt a 100-year-old Hemingray glass insulator and make it into another insulator which in turn, would last another 100 years. Cost, low to begin with—*lower* in service life. Hemingrays sold *only* through jobbers.

30 Hemingrays Ready to Solve Your Inter-Plant Problems

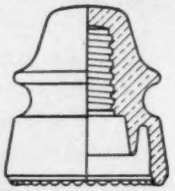
10 Hemingrays for Primary Power Distribution



From this group you can choose Insulators with the following range of characteristics:—

• *Critical Impulse Flashovers* ranging from 75 to 120. • *Leakage Distances* ranging from 4 to 9½ inches. • *Dry Arcing Distances* from 2⅜ to 4⅝ inches. • *Wet Arcing Distances* from 1 to 1¾ inches.

5 Hemingrays for Your Signal Work



From this group you can choose Insulators with the following range of characteristics:—

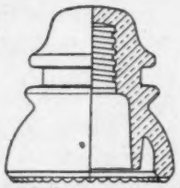
• *Heights* ranging from 3-13/32 to 4 inches. • *Diameters* ranging from 2¼ to 3¼ inches. • *Groove Diameters* ranging from ⅜ to 11/16 inches. • *Thread Diameters* standard at 1 inch in all 5 numbers.

10 Hemingrays for Secondary Power Distribution

From this group you can choose Insulators, Knobs and Spools with the following range of characteristics:—

• *Heights* ranging from 2-15/16 to 5-1/32 inches. • *Diameters* ranging from 2¼ to 3¼ inches. • *Groove Diameters* ranging from 1 to 2 inches. • *Thread Diameters* at 1 inch in all 10 Numbers.

7 Hemingrays for Telephone and Telegraph



From this group you can choose Insulators with the following range of characteristics:—

• *Heights* ranging from 2-13/16 to 4-9/32 inches. • *Diameters* ranging from 2-7/16 to 3¾ inches. • *Groove Diameters* of either 7/16 or ⅝ inches. • *Thread Diameters* standard at 1 inch in all 7 numbers.

RUSH DELIVERY IF YOU NEED IT!

Complete stock of *all* types of Hemingrays are on hand. You can order as many or as few, as you need. Just 'phone your jobber. He can arrange *immediate* shipment.

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Hemingray Division

Please mail a complete Hemingray Insulator Catalog.

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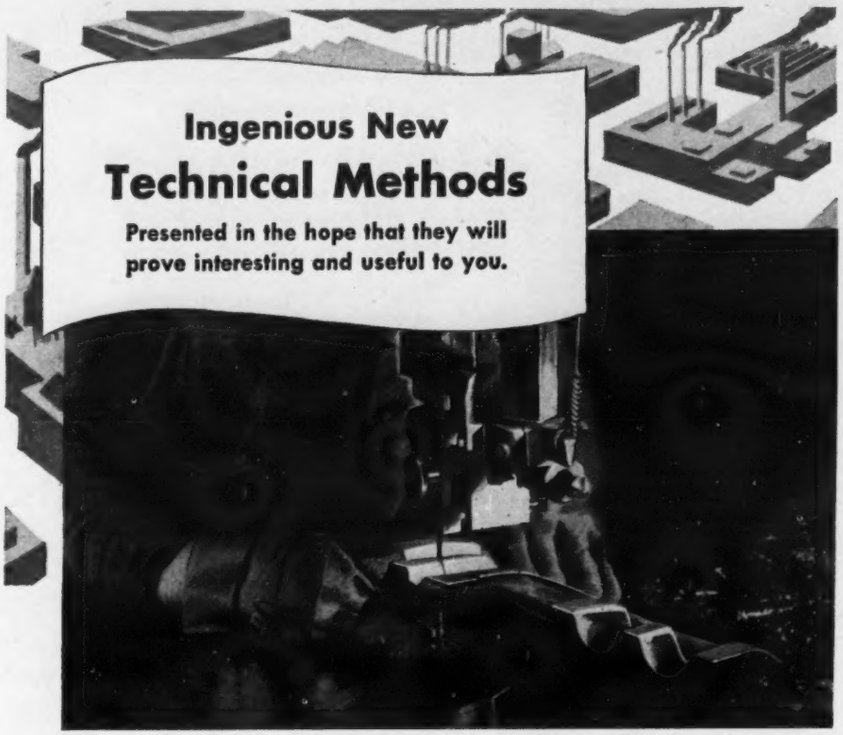
HEMINGRAY Power, Telephone and Telegraph Insulators



Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

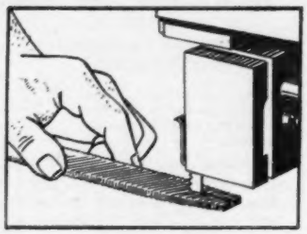
Hard Steels Cut by Heat Generated by Super High Saw Speeds

Ordinary band-saws, when operated at unbelievable high speeds up to 12,000 feet per minute, cut through hard steels and alloys by heat generated from the friction of the saw against the metal to be cut. The cutting effect is more that of burning through the metal than actual cutting. The heat generated is sufficient to melt or burn out the metal in the saw cut but not enough to draw the temper on the sides.

The hardness of either saw or metal to be cut is of little importance. Thin metal sheets are cut like paper, and plates up to one inch in thickness can be cut at speeds of ten inches per minute.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information about this method from Bell Aircraft Corporation, Buffalo, New York.



Proof of ability of new method to cut hard materials is demonstrated by operator cutting a file.

The temper of curve cut section shown above is unaffected.

X-62

Sales Opportunities

IOWA—Central States Electric Co., Cedar Rapids, plans expansion and improvement in steam-electric power plant at Iowa Falls, including installation of new turbine-generator unit and auxiliary equipment. Also will make extensions in transmission lines and local distribution system, with power substation and service facilities. Entire program is estimated to cost about $1,000,000. Project is contingent upon securing a 20-year extension to local franchise, soon to be determined at a special election, and will be carried out, it is understood, as a post-war development.

OHIO—Lake City Malleable Co., 5000 Lakeside Ave., Cleveland, manufacturer of malleable iron castings, etc., has contracted with government for new plant in Ashtabula County, comprising several one-story buildings, with mechanical and electrical equipment for large capacity. A power substation is planned. Entire project will cost about $3,360,000, and will be financed by Defense Plant Corp. Work is scheduled to begin soon.

TEXAS—City Council, Dallas, is considering report submitted by Harland Bartholomew & Associates, 317 North 11th St., Kansas City, Mo., consulting engineers, for expansion in Love Field municipal airport, including acquisition of additional land, with hangars, shops and other buildings, equipped with mechanical and electrical facilities. Also extensions in electrical distribution lines, night-lighting system, control station, etc. Entire project is estimated to cost over $5,000,000, and will be carried out with Federal aid. Woodall Rodgers, Mayor, is active in project.

WASHINGTON—Public Water District No. 66, Black Diamond (King County), plans pumping station with motor-driven pumping machinery, controls and auxiliary equipment, in connection with new water system installation. Entire project will cost close to $100,000. Financing is being arranged and bids are expected to be asked soon. Parker & Hill, Smith Tower Building, Seattle, are consulting engineers.

OHIO—Standard Oil Co. of Ohio, Midland Building, Cleveland, has approved plans for new gasoline refining plant in conjunction with local oil refinery, to be equipped for production of 100-octane gasoline for aviation service. It will comprise large group of one and multi-story processing and production units, with mechanical and electrical facilities. Cost estimated about $8,500,000. Project will have a priority rating and work is scheduled to begin at once. Financing will be arranged with company funds.

NEBRASKA—Loup River Public Power District, Columbus, plans extensions in transmission lines in part of Platte County. State permission has been granted, and work will be carried out at early date. It is understood that project will have a priority rating.

MARYLAND—Public Works Department, Baltimore, plans new pumping station in Brooklyn district in connection with 1944 extensions in sewage system in that area. Plant is estimated to cost about $300,000, with motor-driven pumping units, controls and other electrical facilities. Entire program will represent expenditure of more than $2,600,000. George E. Finck is sewer engineer.

PENNSYLVANIA — Continental Distilling Corp., 1429 Walnut St., Philadelphia, plans expansion in plant for production of alcohol

government, comprising new buildings h machinery and electrical equipment large increased capacity. Cost estimated ut $2,000,000, with financing by Defense nt Corp. Work will be carried out soon.

EVADA—Nevada-Massachusetts Tungsten Mill City, Charles Segerstrom, presi-t, plans early rebuilding of local 250-ton sten-milling plant, recently destroyed fire with loss reported over $450,000, machinery and electrical equipment. onstruction will approximate a like unt. Application is being made for a rity rating.

HIO—National Advisory Committee for naautics, Municipal Airport, Cleveland, eral agency, Edward R. Sharpe, admin-tive manager, plans new research build-for compressor and gas turbine divis-to be one-story, estimated to cost about 82,000, with mechanical and electrical ipment. Proposed to ask bids soon on eral erection contract.

ASHINGTON—Bonneville Power Admin-tion, Department of Interior, 1300 E. Union Ave., Portland, Ore., receives s until Dec. 20 for new 230-kv. trans-sion line from Grand Coulee hydro-ctric generating station to point near k Island on Columbia River, about 73 les (Inv. 3119).

OKLAHOMA—B. F. Goodrich Co., 500 th Main St., Akron, Ohio, manufacturer rubber goods, plans new mill in vicinity Miami for production of automobile tires d tubes from synthetic rubber. It will mprise several large one-story buildings r processing and general production, orage and distributing buildings, power ant and miscellaneous units. Cost re-orted in excess of $1,000,000, with machin-y and electrical equipment. Project will ve a priority rating.

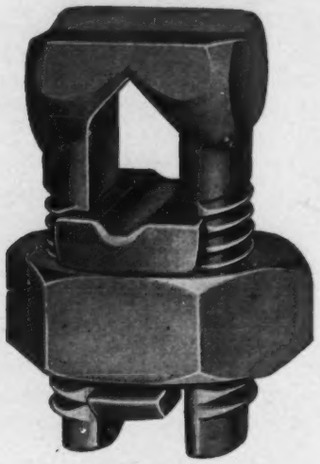
OHIO—National Bronze & Aluminum oundry Co., East 45th St. and Hamilton ve., Cleveland, manufacturer of alumi-um, brass and bronze castings, etc., has lans maturing for expansion and improve-ents in plant for increased production for overnment, with machinery and electrical quipment. Cost estimated approximately ,500,000. Work will begin soon. Financing y Defense Plant Corp.

LOUISIANA—At recent special election, own Council, Winnfield, was authorized arrange bond issue of $260,000, for municipal power plant and system, and aterworks station. It is understood that cal property of Gulf Public Service Co., cluding generating station and distribu-on lines, will be acquired. Extensions are lanned in primary and secondary lines, ervice connections and other facilities.

TEXAS—Town Council, New Boston, plans umping station with motor-driven pumping achinery, controls and auxiliary equip-ent, in connection with extensions in ater and sewage systems. Entire project s estimated to cost about $145,000. It is nderstood that financing will be arranged hrough federal aid. Frank W. Chappell, ourt Building, Dallas, is consulting engi-eer.

FLORIDA—United States Sugar Co., Clew-ston, operating local cane sugar mill, is onsidering new plant in vicinity of present ill for production of starch, using sweet otatoes as raw material. It will comprise everal one and multi-story processing and roduction buildings, with auxiliary struc-ures for storage, distribution, etc. Cost eported close to $3,000,000, with machin-ry and electrical equipment; a power sub-tation is planned. It is understood that pplication will be made soon for a priority ating.

COPPER TO COPPER PREVENTS METALLIC FIGHTS



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FOR COPPER TO COPPER CONNECTIONS

Pure Copper, Cold forged bolt of ample strength for all purposes. High copper content prevents corrosion and season cracking. All edges are rounded. 65,000 pounds tensile value.

"V" groove, clamping jaw of cold forged, pure copper. Flanged sides give greater bearing surface on nut, hence greater strength and no distortion of clamping jaw.

97% copper content, hard metal nut—strong as steel. Full thread engagement with bolt.

Broad, strong head, with size plainly marked. Sides of head have flat surface so wrench or pliers can grip tightly.

85% plus, full thread, die stamped, insures full engagement in nut, hence high strength connectors.

"V" shaped groove, holds wires in three point contact and prevents rocking or looseness.

Made in 12 sizes—6 of forged copper and 6 of machined high strength, high copper content alloy —for No. 10 to 1,000,000 CM conductors.

Send for bulletin and free samples and convince yourself of their superiority.

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44-NU 22-NU

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PORCELAIN INSULATORS
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The day is surely coming when you will again be able to *select* the equipment you need. As specialists in the Quartz Crystal field, the engineers of The James Knights Company are on the constant alert — researching, inventing, designing. You will of course want to do business with one of the "old timers" in the Crystal field. Plan now on using James Knights Crystals in the years to come.

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Any Type, Cut or Frequency

The *JAMES KNIGHTS* Co.
SANDWICH, ILLINOIS

Recent Rate Rulings

ALABAMA POWER CO. has been authorized by the state Public Service Commission to reduce its rural electric rates to 38,000 customers approximately $163,000 a year. Also included in the order was a charge that reduced the cost of electric service to 294 rural day schools now served by the power company's rural lines. The commission stated that its order also would have the effect of providing that whenever any rural line has 15 or more customers, instead of the required 20 as at present, customers will be served under city rates.

STATEN ISLAND EDISON CORP.'s temporary rates established by the New York Public Service Commission were affirmed by the Appellate Division, Third Department, in a three to two decision. In the course of a rate proceeding the commission fixed temporary rates, to which the company objected and obtained an injunction. The matter went before Justice Francis Bergen in Special Term and he decided in favor of the commission, dismissing the injunction. The Appellate Division denied a motion for a stay of the commission's order pending appeal to the Court of Appeals. Justice Schenck who wrote the dissenting opinion in which Justice Bliss joined, pointed out that the temporary rates must provide a return of not less than 5 percent, but the schedule as fixed by the commission fixed only 2.9 percent. Justice John C. Crapser, in the prevailing opinion, summarized the four causes of action. He stated that the value of the Staten Island Edison Corp.'s usable property as of December 31 last was in excess of $15,914,272 and that its earnings for the year 1942 resulted in a return of 3.33 percent upon the "fair value." The corporation reduced its rates in May, 1942, and asserted that if the reduction had been in effect during the entire year the revenues would have been $40,000 or $45,000 less. It contended the rate prescribed by the commission would result in a further reduction of annual revenue of $230,000. The corporation's complaint set forth that the original cost of the property was $15,023,924; that the depreciation was $2,637,455. Net earnings in 1942 were $530,651, added to the original cost less depreciation a working capital of $664,272 and alleged that the 1942 earnings represented 4.07 percent. Justice Crapser pointed out that this sum for working capital is not allowable. He also said there was no question of confiscation; that when the final rate is made and if the corporation has suffered a loss it can be remedied by fixing the permanent rate high enough so that the loss can be returned to the corporation.

DALLAS POWER & LIGHT CO.'s rate reductions of $685,400 in 1943, retroactive to January 1, and a new indeterminate service-at-cost franchise have been accepted by the city council and the utility company as the outcome of new negotiations. The council passed the revised franchise late in October. A previously agreed-to ordinance that had been given two readings was laid aside in favor of the freshly drafted measure. If the franchise is finally passed within the 30-day period and a petition for an election on approval of the document is filed in due course, voters will pass on it December 28.

SOUTHEASTERN INDIANA POWER CO. customers have filed two petitions for electric rate reductions and improved service with the state Public Service Commission. Residents of Acton and New Bethel were on the petition.

WISCONSIN PUBLIC SERVICE COMMISSION

THESE PARAGONS OF PERFORMANCE *Speed output*

They save precious man-hours . . . step up human efficiency . . . aid mightily in reaching those high-production goals.

Paragon Automatic Timers are being used in thousands of industrial operations . . . such as: Watchman signals, power disconnect, conveyor operation, pump operation, light exposure, liquid agitation, enamel baking, heat treating, rubber curing, plastic molding, etc.

Ask a Paragon Timer Engineer to help plan your present or post-war equipment. No charge; no obligation.

WRITE FOR THIS BOOK

. . . Describing industrial timers, time-switches and other time controls. Contains illustrations, construction and installation data, list prices and reference information.

• Manually reset interval timer 4⅜" high, 2½" wide, 1⅜" deep, for surface mounting on standard handy box.

PARAGON ELECTRIC COMPANY
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BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

has reported that utility rate reductions in Wisconsin in the first nine months of 1943 amounted to $570,264. As an offset, there were increases aggregating $45,000. Electric utility companies accounted for $288,252 of the total reductions.

MARION RESERVE POWER CO. placed in operation on November 1 new domestic electric rates, effective for ten years. City council approved the new schedule. It is estimated that the new rate will save average users 20 cents a month.

KAUKAUNA (WIS.) municipal utility will reduce its electric rates, effective with billings of December 8, by $18,382 a year, the state Public Service Commission has announced. The rate reduction, the fifth in the past 12 years, will affect residential, commercial and rural users of power. H. E. Weckwerth, superintendent of the utility, said that residential users would benefit most from the reduction, an average of from 10 to 30 cents per month. The fixed rate changes will be from 65 to 55 gross and from 60 to 50 cents net. The rate change steps have been changed from 60 to 50 kw.-hr. at 2½ cents net, from 120 to 100 at 2 cents with a new step of 150 kw.-hr. at 1½ cents and over 300 at 1 cent net.

OHIO EDISON CO. has announced new electric rates for consumers using between 100 and 300 kw.-hr. a month in Youngstown. A maximum saving of 25 cents a month for 200 kw.-hr. is provided in the new rate schedule recently approved by city council. The new rate, effective December 1, adopted at the request of the company, is identical with the existing Akron rates, and will provide for savings to consumers estimated by the company to be approximately $21,000 a year.

•

Commission Orders Write-Up Eliminated

The Federal Power Commission announced last week its order and opinion (No. 108) directing the Utah Light & Traction Co. of Salt Lake City, Utah, not only to eliminate a $1,916,077.32 write-up of its plant account by an immediate charge to earned surplus, but also to complete and file with the commission on or before June 1, 1944, original cost and reclassification studies with respect to $19,291,901.05 representing the remainder of the company's plant accounts as of December 31, 1936.

Last week's opinion states that the Utah company, which concedes that the amount is classifiable as a write-up, has proposed no plan of disposition, and adds that: "We have consistently held that write-ups should be eliminated from plant account immediately. We adhere to that principle here and find that, in accordance with sound principles of accounting, the write-up of $1,916,077.32 should be deposed of from Account 107, by a charge to Account 271, Earned Surplus."

According to the opinion, on August 6, 1914, Utah Securities Corporation (a wholly owned subsidiary of Electric Bond & Share Co.) organized Salt Lake Light & Traction Company, with a

MATTHEWS CONNECTORS

For All Kinds of Wire Connections Without Solder

NUTYPE SERVICE CONNECTORS

For copper to copper—in 12 sizes.

With or without Nut Retainers.

Also available in some sizes for aluminum to aluminum and copper to aluminum connections.

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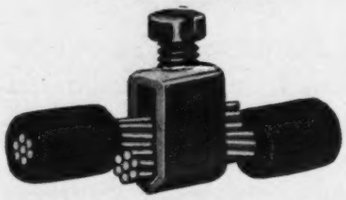

A sturdy and economical means for connecting house service or other end to end copper connections (not under tension).

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and small copper wire connector.

Vice type—strong and easily connected or disconnected.

PARALLEL CLAMPS

For connecting small tap off wires to larger main conductors at a saving.

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BEN-HUR TRAILER ENGINEERING applied to your post-war plans may show you, too, new uses for handy trailer units—to move tools to the job, to mount vital machine units, carry supplies and materials, or for mobile service units.

Take advantage of Ben-Hur's experience in trailer design and engineering to help YOU to new progress in post-war business planning.

Write for our data sheet to aid your post-war planning.

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capitalization of $1,000,000 par value of common stock, all of which was subscribed and paid for in cash by Utah Securities Corporation. On September 18, 1914, Salt Lake Light & Traction Co., was consolidated with Utah Light & Railway Co. to form Utah Light and Traction Co. Such was the origin of the write-up in question, according to the commission's opinion handed down last week.

•

Wisconsin Electric Costs Decrease

The cost per unit of electricity in Wisconsin continued to decrease during the past year to keep the state cost well below the average for the nation, the state Public Service Commission said last week. Lower unit cost was indicated by the fact that the use of electricity increased nearly 13 percent, while the cost increased only about 7 percent. The additional use included a 20 percent increase by large industrial and commercial customers, 13½ percent by rural users and about 7 percent by residential customers.

Nearly 86 percent of the electric utility business in the state was done by the eight largest utilities, Wisconsin Electric Power, Wisconsin Power & Light, Wisconsin Public Service, Wisconsin Gas & Electric, Northern States Power, Wisconsin Michigan Power, Madison Gas & Electric and Lake Superior District Power. The 49 smaller private utilities accounted for 6 percent of the business and the 89 municipal utilities for slightly more than 8 percent.

While electric utility revenues have increased steadily and substantially since 1935, they have been offset in large degree by increases in operating expenses and taxes.

•

Industrial Thermometers Further Standardized

Further standardization and simplification of industrial and special purpose thermometers have been effected by WPB with the addition of Schedule VII to Order L-272. The amended order eliminates several types and sizes and numerous special features of existing models.

Production is expected to increase as much as 10 percent as a result. Scale ranges between minus 40 and plus 950 deg. F. are restricted to a definite list. Cases and case fronts may not be made of copper or copper alloy other than tubing or cylindrical extruded shapes.

"SURCO-AMERICAN"
means **PRETESTED**
under all conditions

"Surco-American" high quality flexible plastic tubings and insulated wire are pretested to stand up under a wide range of temperatures and under the most severe conditions because they are specially formulated to meet the most exacting requirements. Tubings are available in inside diameters from .005" to 2". Dielectric strength averages 1500 volts per mil. thickness . . . "Surco-American" flexible plastic insulated wire is available in all lengths and colors in wire sizes #12 to #48 A.W.G. solid or stranded, shielded, tinned or silver plated copper wire and cable . . . Technical bulletins and samples on request.

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INSULATED TOOLS

Reduce accidents and service interruptions

COHARDITE insulation molded on H. K. Porter bolt cutters protects the Linemen and equipment with a tested 20,000 volts dielectric. Available in #0, #1, and #2 sizes with either rigid or swivel head.

Every tool tested to its full rated dielectric strength for one minute R.M.S. before it leaves our plant.

A full range of COHARDITE insulated small tools carried in stock for meter and distributor departments.

Send for a catalog

The Connecticut Hard Rubber Co.
NEW HAVEN, CONNECTICUT

Crapo STEEL CONDUCTOR

Rural distribution lines of *Crapo* Steel Conductor will prove efficient, economical and dependable for years under normal operating conditions. The rugged tensile strength inherent in this conductor makes possible long-span, low-cost construction requiring a minimum of maintenance. Relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance contribute to improved electrical efficiency.

For rural extensions authorized by Utilities Order U-1-c, specify No. 6 B.W.G. *Crapo* HTC-130 Stranded (3-wire) Conductor—the size and type recommended for the purpose. For information on this or other applications, contact the nearest office of the Graybar Electric Co., Inc., Distributors, or write direct for Engineering Manual containing complete information on *Crapo* Steel Conductors.

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

New REA Allotments Total $53,000

The Rural Electrification Administration recently announced allotments totaling $53,000 to three co-operatives in Texas and West Virginia. This brings total allotments to date to $471,538,973, of which $4,592,678 represents operations during the current fiscal year.

In announcing these new allotments, Administrator Harry Slattery pointed out that no construction will be undertaken without WPB approval.

The Harrison Rural Electrification Association, Inc., Clarksburg, West Virginia, received funds amounting to $10,000, to be used to extend electric service to nearby farms meeting War Production Board standards outlined in the increased food-production program.

The Wood County Electric Co-operative, Inc., Quitman, Texas, received $21,000 and Farmers Electric Refrigeration Co-operative, Inc., Emory, Texas, received $22,000. Both these allotments will provide for construction of refrigerated locker plants with food-processing facilities.

•

Electronics in Industry Described in RCA Book

A clear-cut exposition of the practical part electronics is playing in various industrial fields, as differentiated from the fanciful, "blue-sky" imaginings of some current writers, is graphically presented in a 44-page booklet just released by the RCA Victor Division of Radio Corporation of America, Camden, N. J.

Profusely illustrated in color, and written in nontechnical language, this booklet, "Electronics in Industry," is being made available to business executives, manufacturers and industrialists in whose fields the science of electronics may find applications.

•

Subcontractors Produce 50% of War Sales

Western Electric Co., in a recent report to the War Production Board and the Smaller War Plants Corporation, disclosed that 50 percent of the company's total sales of war materials to the government since U. S. entry into the war had been produced by subcontractors. In meeting its commitments to the government Western Electric Co. currently does business with more than 6,500 subcontractors and suppliers.

--and no brazing expert needed!

There's a valuable lesson for post-war manufacturing in the making of these Navy Switch Box Covers. It's the **high production with inexperienced operators** you get with the low-temperature silver brazing alloy EASY-FLO.

All you need is a simple procedure and fast heating method, designed to take full advantage of EASY-FLO's exceptional brazing speed.

In making the switch boxes, EASY-FLO is preplaced in the form of rings and pieces cut to suit, and induction heating is used with an automatic device which turns current on and off at a predetermined interval. While one cover is brazing, another is prepared. You can readily appreciate the high production possibilities of this simple EASY-FLO brazing set-up.

But this case is not exceptional. It's typical of results being obtained with EASY-FLO on a wide variety of electrical parts—many of which have been redesigned for EASY-FLO brazed construction—a construction which is made practical by the remarkable strength of EASY-FLO joints.

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DO YOU HAVE TO "FISH" FOR CORRECT VOLTAGE?

Your equipment can be operated at exactly the right voltage. POWERSTAT Variable Transformer control of voltage to precise limits can be made either manually or automatically. No longer is it necessary to operate electronic apparatus, heating and testing equipment and other devices at the off nominal voltages that exist on today's heavily loaded lines. Standard POWERSTATS in sizes up to 75 KVA for single or polyphase operation on 115, 230 or 440 volt circuits are designed to replace coarse tap-changing transformers and rheostats having poor regulation and limited range.

Specify POWERSTAT Variable Transformers, manufactured by SUPERIOR ELECTRIC COMPANY, the voltage control specialists.

SEND FOR BULLETINS 149 WE and 163 WE

SUPERIOR ELECTRIC COMPANY, 42 LAUREL ST., BRISTOL, CONN.

SUPERIOR *Electric Company*

Make the Line Terminations the Easy Way—
Nicopress SUSPENSION DEAD-ENDS

Nicopress Suspension Dead-Ends simplify and reduce to a minimum the time and labor required in making open wire terminations on distribution lines. Designed for use with disc insulators and assembled all in one unit, they are speedily installed. They are available for steel, copper, and copperweld conductors.

In the Nicopress Suspension Dead-End the conductor goes straight into the sleeve section without bending or distortion. This assures great strength and tightness of the connection and increases to a remarkable degree its resistance to vibration.

In the Suspension Dead-End provision is made for a tail of any desired length so that jumper connections or tap-offs may be speedily installed.

ORDER FROM YOUR JOBBER

THE NATIONAL TELEPHONE SUPPLY CO.

Manufacturer of Specialties for Power and Communication Lines

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Canadian Mfr.—N. Slater Co., Ltd., Hamilton, Ont., Canada
Export Distributor—International Standard Electric Corp., New York, N. Y.

Nehring Gets Contract for ACSR Conductor

Several sizable contracts for ACSR conductor have recently been awarded to the Nehring Electrical Works, De Kalb, Ill., manufacturer of bare and weatherproof wire and cable.

The aluminum rod which will be fabricated into the finished product is being furnished by the Aluminum Company of America with WPB authorization. The aluminum rods will be produced in the Aluminum Company plant at Massena, N. Y. The Nehring Electrical Works will begin shipment of the finished conductor about four days after the first raw material is delivered to its plant.

This cable is being furnished for both utilities and government agencies, which is urgently needed in connection with vital defense projects.

Until the recent contracts for ACSR conductor were placed with the Nehring Electrical Works, its operations were confined exclusively to the fabrication of bare and weatherproof copper wire and cable.

Officials of the Nehring organization state that their entrance into the field of aluminum cable fabrication is in line with the greatly increased importance of aluminum conductor in post-war transmission construction.

•

Average Daily Output at New High Level

Average daily production of electric energy for public use in October was 674,819,000 kw.-hr., a new high level and an increase of 2.1 percent over average daily production during the previous month, according to the report issued by the Federal Power Commission.

Electric energy produced for public use during the month totaled 19,299,831,000 kw.-hr., an increase of 17.0 percent over production in October, 1942. Production by water power in October amounted to 5,486,034,000 kw.-hr., or 28.4 percent of the total output for public use.

•

Lincoln Welding Course Held in Cleveland

In response to urgent demands for more details on the latest methods and techniques on arc welding, the Lincoln Electric Co., Cleveland, Ohio, instituted a five-day engineering course at the company's plant, which was attended by engineering, research and welding executives of some of the country's lead-

REDUCE INSIDE "DIM-OUT" AREAS

Ease of seeing and illumination of *vertical* work surfaces like this are materially increased by a reflecting floor made with Atlas White cement.

Light reflected from below—by a floor made with Atlas White cement—reduces shadow areas and throws more useful light on the working surface. The results: improved seeing conditions, comfort and efficiency, and increased production.

Proof of the effectiveness of Light-Reflecting Floors in wartime installations points to the value of considering floors as a contributing factor in post-war lighting of plants and factories. In one bomber plant, lighting tests showed that a white cement floor reflected 20% more light to *vertical* surfaces than did an adjacent gray cement floor under the same lighting conditions—61% more to underwing surfaces.

Consider Light-Reflecting Floors for war and post-war construction or conversion. For complete information about them, write for our free 24-page booklet, "Light from Floors." Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Bldg., New York 17, N. Y.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

EW-F-24

ATLAS WHITE CEMENT

For Light-Reflecting Floors

ing companies. The course, which started November 1, was conducted by W. J. Conley, Lincoln welding consultant. It is expected that these courses will be held monthly in the future.

•

Warns on Threat of Chain Competition

Independent electrical appliance dealers and electrical appliance manufacturers must begin actual post-war planning now if they are to survive post-war merchandising competition, according to George H. Smith, general sales manager of Hotpoint, in the first of a nation-wide series of Hotpoint sales meetings held in New York recently.

"The first and by far the greatest threat to our present method of doing business is the chain operator. Make no mistake about it; if the chain operators develop their stores into mass outlets, there will cease to remain a place in the picture for the small independent retailers as we know them today. And if this business goes to large mass outlets, the basic functions of wholesaling will become a small factor in the major appliance business."

•

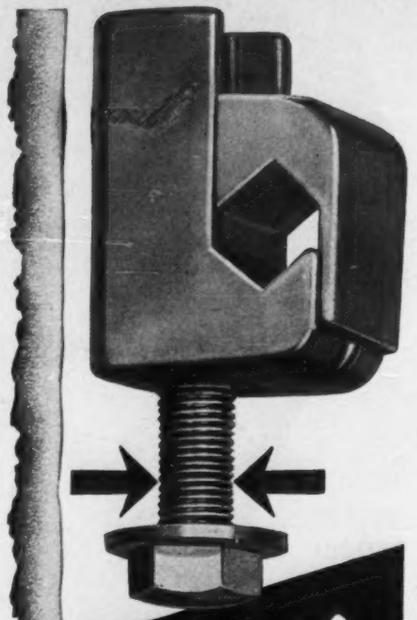
Instrument Production Soars 4,000 Percent

Production of the electrical indicating and measuring instruments essential to fight a mechanized war have soared 4,000 percent in the three years since 1940—from 700,000 units annually to 28,000,000—H. P. Sparkes, chairman of N.E.M.A.'s electrical measuring instrument section and application manager of the Westinghouse meter division, Newark, N. J., said in a recent report on the wartime production record of the instrument industry. Scheduled 1944 output of 39,000,000 units—a 40 percent increase—means that the instrument industry will produce 55 times as many units as it did in 1940, according to Mr. Sparkes.

•

Western Electric War Show for Employees

To bring to its employees a realization of the vital importance of their work in the success of the nation's arms, the Western Electric Co. is presenting a series of animated dioramas at its different plants. The show, housed in a circus tent, vividly demonstrates how



why FARGO CONNECTORS tighten so easily

The SMALL BOLT in the Fargo Connector cuts friction to a minimum, tightens the tap in smooth, easy turns. Clean, precisely machined threads in both the bolt and connector body further assure easy, friction-free turning and high pressure contact at low torque. And remember, you can count on a Fargo to "grip like a vise" even after years of repeat use on the line.

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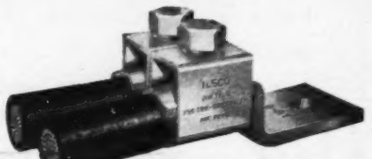

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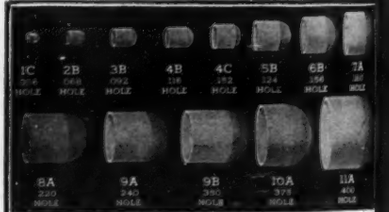

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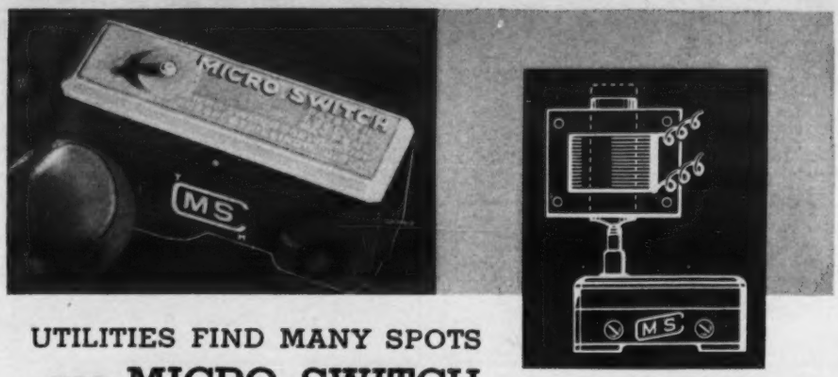

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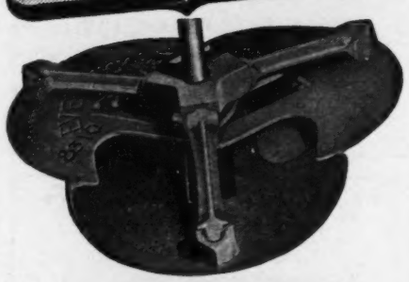

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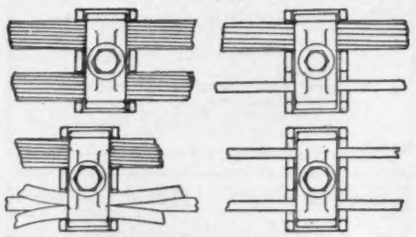

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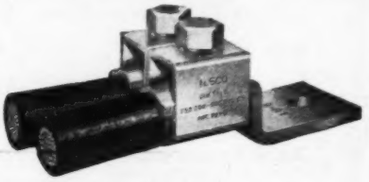

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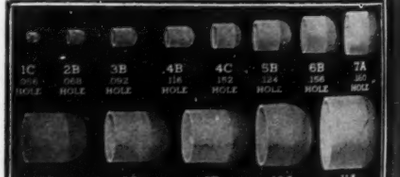

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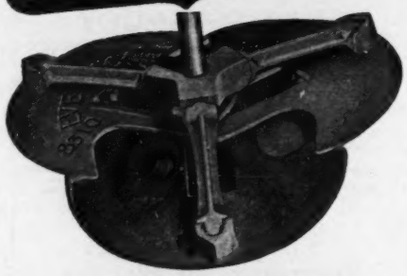

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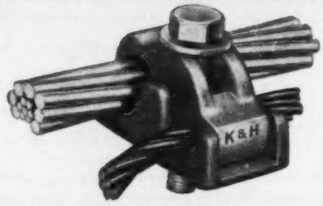

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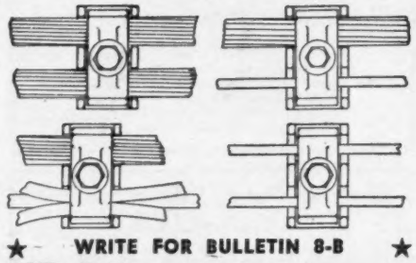

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254 Essex Street **Salem, Massachusetts**

ADDITIONAL EMPLOYMENT ADVERTISING ON PAGE 174

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in

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Westinghouse Reduction Gear Ratio 4.05:1

Transmits 300 HP at 150 RPM

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1—two panel switchboard, 4 rear switches, 7,500 Volts.

1—oil circuit breaker, 400 Amp. 15,000 Volt, 50,000 KVA rupturing capacity, 3 trip coils 3 current transformators 250:5 for tripping.

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Departmental Staff

ELECTRICAL WORLD

330 W. 42ND STREET, NEW YORK 18, N. Y.

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MOTORS GENERATOR SETS

000 Ampere, 6 volt, Hanson-Van Winkle.
500 Ampere, 6 volt, Hanson-Van Winkle.
50 KW, 250 volts, Allis-Chalmers, synchronous
5 KW, 125 volts, Crocker-Wheeler, synchronous
½ KW, 125 volt, General Electric, squirrel cage.

MOTORS—3 PHASE 60 CYCLE

00 HP, 514 RPM, 440 volt, Westg. slip ring
50 HP, 300 RPM, 440 volt, G.E., slip ring
35 HP, 600 RPM, 2300 volt, GE, syn.
00 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
50 HP, 514 RPM, 4000 volt, G.E., syn.
50 HP, 600 RPM, 4000 volt, G.E., sync.
50 HP, 600 RPM, 2200 volts, G.E., slip ring
00 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
50 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
50 HP, 720 RPM, 440 volt, G.E., slip ring.
00 HP, 900 RPM, 440 volt, Lincoln, sl. rg.
50 HP, 400 RPM, 440 volt, G.E., sq. cg.
35 HP, 720 RPM, 440 volt, G.E., slip ring
00 HP, 900 RPM, 440 Westinghouse, sq. cg.
00 HP, 900 RPM, 440 volt, G.E., slip ring.
00 HP, 720 RPM, 440 volt, G.E., slip ring.
00 HP, 720 RPM, 440 volt, G.E., sq. cg.
00 HP, 600 RPM, 440 volt, G.E., slip ring.
00 HP, 600 RPM, 440 volt, G.E., sq. cg.
00 HP, 514 RPM, 440 volt, G.E., sq. cg.
00 HP, 450 RPM, 440 volt, G.E., sq. cg.
0 HP, 400 RPM, 550 volt, Cr. Whir. sq. cg.
75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
75 HP, 900 RPM, 440 volt, G.E. sq. cg.
75 HP, 720 RPM, 440 volt, Westghse, slip ring.
75 HP, 720 RPM, 440 volt, G.E., sq. cg.
50 HP, 900 RPM, 440 volt, G.E., slip ring.
50 HP, 900 RPM, 440 volt, G.E., sq. cg.

1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—200 HP, 440 volt, 600 RPM, Crocker-Wheeler, slip ring.
1—300 HP, 720 RPM, 2200 volt, General Electric, slip ring.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM, Westinghouse, type SK.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, G.E., 625 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, General Electric, 2200-220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, General Electric, 2200-220/110 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
3—75 KVA, G.E., 2200/220/110 volts.
1—75 KVA, G.E., 2400/4800/120/240 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
3—50 KVA General Electric, 2200/220/110.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440.
2—30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Croccker Wheeler.
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

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600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

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Service backed by 38 years' experience

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1—1500	Whse.	720	650	11500
1—1250	G.E	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	3600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1— 500	G.E.	720	600	2200
1— 500	G.E.	720	600	13200
1—.400	G.E.	720	250	2300

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1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

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PROFESSIONAL SERVICES .....

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SEARCHLIGHT SECTION

(Classified Advertising)

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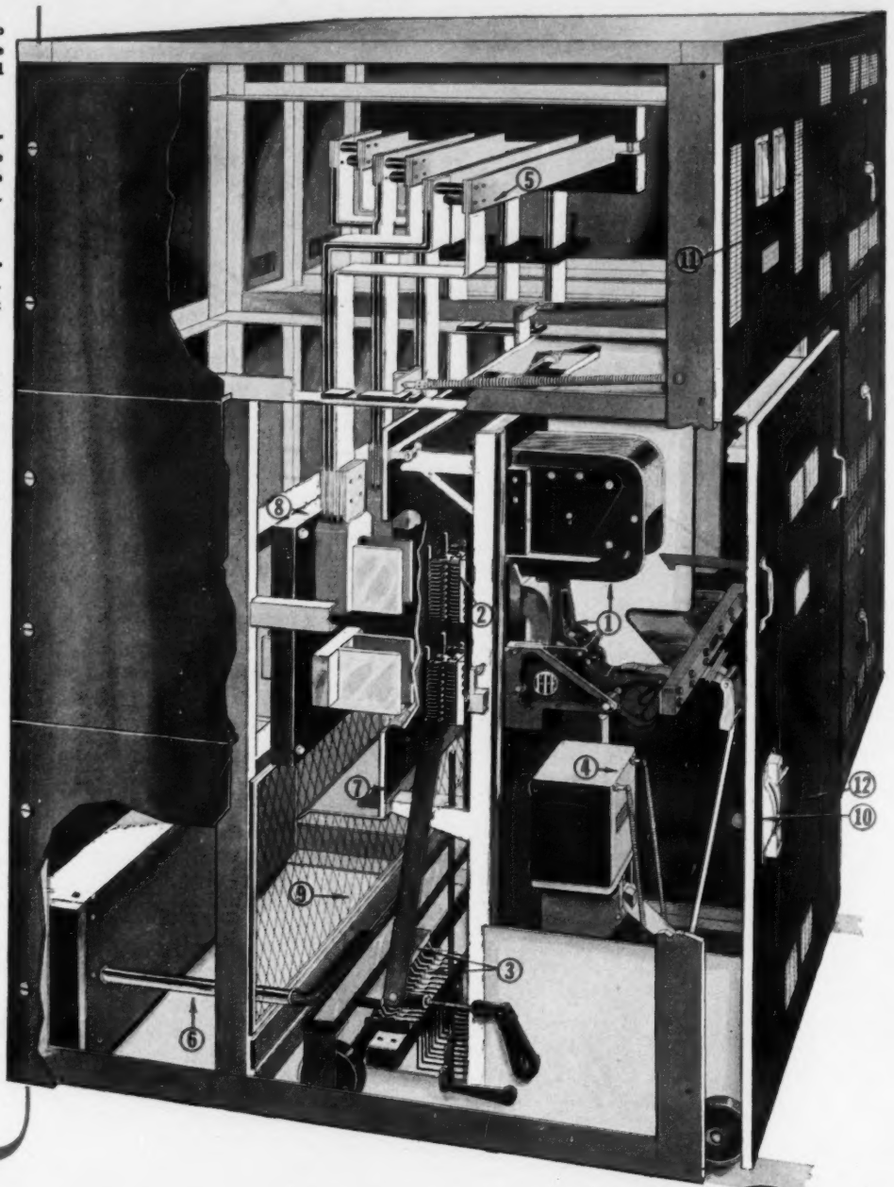
★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

Truck Mounting Details

IN I-T-E DRAWOUT SWITCHGEAR

Features identified in this cutaway view show I-T-E design working in the interest of the switchgear purchaser. They are typical of the I-T-E approach to the making of switchgear; they promote safety, convenience and long life—and reduce maintenance. Other arrangements that would "work" might be devised but they would not be "I-T-E" unless they also protected the user's investment.

For more details on the features of I-T-E drawout switchgear, send for Bulletin 4207—"Multumite Switchgear Assemblies, Drawout Type."



1. **LARGE AIR CIRCUIT BREAKER**—To save handling time, drawout type breakers rated 2000 amperes and above are mounted in trucks.

2. **PRIMARY DISCONNECTING DEVICES**—Safe inspection, away from live parts, is provided by mounting the self-aligning fingers on the truck. Silver surfaces prevent overheating.

3. **SECONDARY DISCONNECTING DEVICES**—For control and other small wiring. Silver-surfaced contacts are closed at Test Position.

4. **ELECTRIC OPERATING MECHANISM**—Dependable operation and low current demand are attained with this trip-free, solenoid mechanism.

5. **SILVER-SURFACED BUSES**—Silver gives lasting immunity from overheating at the joints.

6. **CONTROL WIRING CONDUIT**—Connects to covered terminal box.

7. **PROTECTION SHEET**—Covers live contacts when truck is withdrawn from housing.

8. **MALE DISCONNECTING-DEVICE BASE.**

9. **SAFETY SCREEN.**

10. **POSITION-INDICATOR HOUSING** — Also encloses trip and reversing linkage handle, and socket for drawout lever.

11. **HINGED INSTRUMENT PANEL**—Provides ample space for instruments, meters, transfer switches and test blocks.

12. **HINGED DOOR**—Gives free access to circuit breaker and operating mechanism for inspection and testing. Door may be opened without taking breaker out of service.

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

I-T-E

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA 30, PA.

Coverage for the life of your turbine

Why you avoid troublesome deposits . . . never need clean your turbine*. . . when you use Nonpareil

Turbine oil deposits (except those caused by operating under dusty or other outside contaminating conditions) stem from two types of unstable hydrocarbons. One of these tends to form asphaltenes. This type can be entirely removed by refining, but only with the certainty of also removing valuable natural inhibitors. Such removal makes the oil more likely to develop acids than it was originally. (And acids form sludge.)

Common practice, therefore, is to remove as large a percentage of the asphaltene-formers as the refiner dares. The balance, left in the oil, is like a bad apple in a barrel. It contaminates the oil and causes deposits, which are part of the familiar and troublesome sludge.

The other problem—acid-formation—can't be prevented by any refining practice we know about. This, too, contaminates conventional oil. Thus the problem is to remove all the asphaltene-formers without harming the oil, and to prevent the formation of acids.

How Nonpareil solves the problem. In refining Nonpareil Turbine Oil, we remove every trace of asphaltene-formers—even though, by so doing, we also take out natural inhibitors. We can do this, because we add synthetic inhibitors that actually do a better job than the natural ones.

That is the basis for our patent on Nonpareil. It is the advantage, exclusive with Nonpareil, that lets us give a written guarantee that the acidity will not exceed the extremely low limit of 0.15 mgKOH/gm for the life of your turbine!

The effectiveness of this method of manufacture is demonstrated by service records on turbines in which Nonpareil is still operating after 16 years without sweetening, batch treatment, or replacing, and with no sign of troublesome deposits.

Corrosion control another feature. A corrosion inhibitor has been used in Nonpareil Turbine Oil since 1926. But a continuous study of this problem has been carried on. Hundreds of materials have been examined and thousands of tests made. An improved corrosion inhibitor is now used in Nonpareil which meets all requirements of corrosion protection without impairing other desirable qualities.

Recently the American Society for Testing Materials developed test D665-42T for determining the ability of turbine oil to aid in preventing the rusting of ferrous parts in the presence of water. Nonpareil Turbine Oil passes this test with perfect results.

Get all the facts. A Standard Lubrication Engineer will be glad to supply full test data and service records on Nonpareil. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 5, Illinois. In Nebraska, address Standard Oil Company of Nebraska at Omaha 2.

Oil is Ammunition . . . Use it Wisely

NONPAREIL TURBINE OIL

*Except when replacing other turbine oil with a fill of Nonpareil

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING